Communication and
Adoption Evaluation of

USDA Water Quality Demonstration Projects

Evaluation Report

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The views presented in this document are not necessarily those of the university reviewers, the water quality program staffs of USDA and state and county cooperators, USDA evaluation staffs, or the USDA agencies that supported this evaluation. The content of this evaluation report is the sole responsibility of the authors.

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Copies of the above Technical Reports are available, in limited quantity as long as copies last, from: Department of Agricultural Journalism, University of Wisconsin, Madison, WI 53706.

Copies of this *Evaluation Report* and the *Executive Summary* are available as long as copies last, from: Plant and Animal Science Production, Protection, and Processing, CSREES/USDA, Washington, D.C. 20250-2220.

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Introduction

Increasing concern over the Nation's water quality led to a 1988 Presidential Initiative to protect surface water and groundwater from pollution by fertilizers, pesticides and agricultural wastes. Responding to this initiative, in 1989, the U.S. Department of Agriculture (USDA) and its state and local cooperators launched a national Water Quality Program.

The program's goal has been to provide farmers and ranchers with the knowledge and technical means to independently and voluntarily address on-farm environmental concerns and related state water quality requirements, while maintaining agricultural productivity and profitability (U.S. Department of Agriculture and Cooperating State Agencies 1989, 1). This goal is qualified as follows: "The Department plans to achieve this goal in a way that reduces the need for restrictive regulation...," articulating an intent for the program to bring about reductions in agricultural contaminants of water.

Planning for the program was based partly on experience gained by the USDA and the Environmental Protection Agency (EPA) in their jointly conducted Model Implementation Program and Rural Clean Water Program (RCWP). Charged with finding ways to prevent and/or reduce agricultural nonpoint source pollution, the RCWP (Office of Water 1990) was conducted for a ten-year period. Lessons learned from this program during the 1980s, regarding the impacts of land treatment on water quality, are documented (Spooner, Gale, Britchford, et al. 1991).

USDA's Water Quality Program with state cooperators brought a new focus to the goal of protecting the Nation's water resources from pollution. This new focus is distinguished by:

- dealing nationally with contaminants from agricultural sources; and
- intensive interagency coordination, collaboration and program integration in order to achieve program objectives.

To achieve its goal, USDA's Water Quality Program funded three interrelated components: (1) Education, Technical and Financial assistance; (2) Research and Development; and (3) Database Development and Evaluation. Water Quality Demonstration Projects in 16 states across the Nation comprise part of the Education, Technical, and Financial Assistance component of the program. The demonstration projects were located in multi-county areas with agriculturally-related water quality risks and problems.

USDA's Demonstration Projects were designed to *accelerate voluntary adoption of agricultural practices that protect surface and groundwater, while maintaining farm and ranch productivity and profitability.* Producers' economic concerns generally precede their water quality concerns—hence the need for these projects to emphasize the profitability of the recommended practices. *The objective of the demonstration projects has been to encourage producers to more quickly adopt cost-effective management practices that can reduce levels of agricultural fertilizers, pesticides and other pollutants in surface water and groundwater.*

The 1989 USDA Water Quality Program Plan called for an evaluation of the performance and effects of the eight 1990-initiated demonstration projects. Intended to cover the period 1991–94, the evaluation was to examine the "extent that improved practices are adopted by producers in each area, the costs of implementation, and the environmental improvements obtained as modified systems are implemented" (U.S. Department of Agriculture and Cooperating State Agencies 1989, 21).

This report summarizes an evaluation of the early performance of the demonstration projects relative to USDA's objective to *quickly accelerate* adoption of water quality practices. The evaluation emphasizes examination of the role of information and education in these projects. Recommendations are offered to improve both future USDA water quality programs and state water quality projects funded by such future programs.

The Demonstration Projects

The sixteen demonstration projects of USDA's Water Quality Program have been jointly conducted by the Cooperative Extension System (CES), including USDA's Cooperative State Research, Education, and Extension Service (CSREES); Natural Resource Conservation Service (NRCS); and Farm Service Agency (FSA). Eight demonstration projects were funded in Federal fiscal year (FY) 1990, and the other eight were funded in FY 1991. *This evaluation focuses on the 1990 projects, located in California, Florida, Maryland, Minnesota, Nebraska, North Carolina, Texas, and Wisconsin* (see Figure 1). All of the 1990 projects are scheduled to conclude by the end of FY 1998; two of these projects already have concluded.

The eight demonstration projects have promoted the adoption of a mixture of agricultural production practices that can protect/improve water quality. The major water quality and commodity production foci of each project have been as follows.

California (Colusa, Glenn, and Sutter Counties): demonstrates irrigation and pesticide management to reduce pesticide residue in surface waters—irrigated rice production.

Florida (Manatee County): demonstrates irrigation and crop management systems including computer decision models, to reduce nutrient and pesticide loadings to surface water and groundwater—irrigated citrus and vegetable production.

Maryland (Carroll and Frederick Counties): demonstrates fertilizer application and animal waste management to reduce nutrient, pesticide, and bacterial loadings to surface and groundwater—corn, soybean, legume, and dairy production.

Minnesota (Anoka, Benton, Chisago, Hennepin, Isanti, Mille Lacs, Ramsey, Sherburne, Stearns, Washington, and Wright Counties): demonstrates nutrient, crop management, and animal waste systems to reduce nitrate and pesticide loadings to groundwater—corn, sweet corn, soybean, legume, and small grain production.

Nebraska (Adams, Clay, Filmore, Franklin, Hamilton, Harlan, Kearney, Nuckolls, Phelps, Polk, Saline, Thayer, Webster, and York Counties): demonstrates nitrogen, irrigation, and pest management practices to reduce loadings of nitrates and pesticides to groundwater—irrigated corn and soybean production.

North Carolina (Duplin County): demonstrates nutrient, pest, and animal waste management systems to reduce nutrient, pesticide, and bacterial loadings to surface water and groundwater—mixed crop production and poultry production.

Texas (Bandera, Medina, and Uvalde Counties): demonstrates vegetative management as well as nitrogen and pesticide practices to reduce pesticide and nitrogen loadings to groundwater—mixed crop production and beef production.

Wisconsin (Brown County): demonstrates crop management and animal waste systems to reduce nutrient, pesticide, and bacterial loadings to surface water and groundwater—corn production and dairy production.

In conducting these water quality demonstration projects, CES and NRCS have provided joint operational

The Eight 1990 Water Quality Demonstration Project Sites and Comparison Areas △

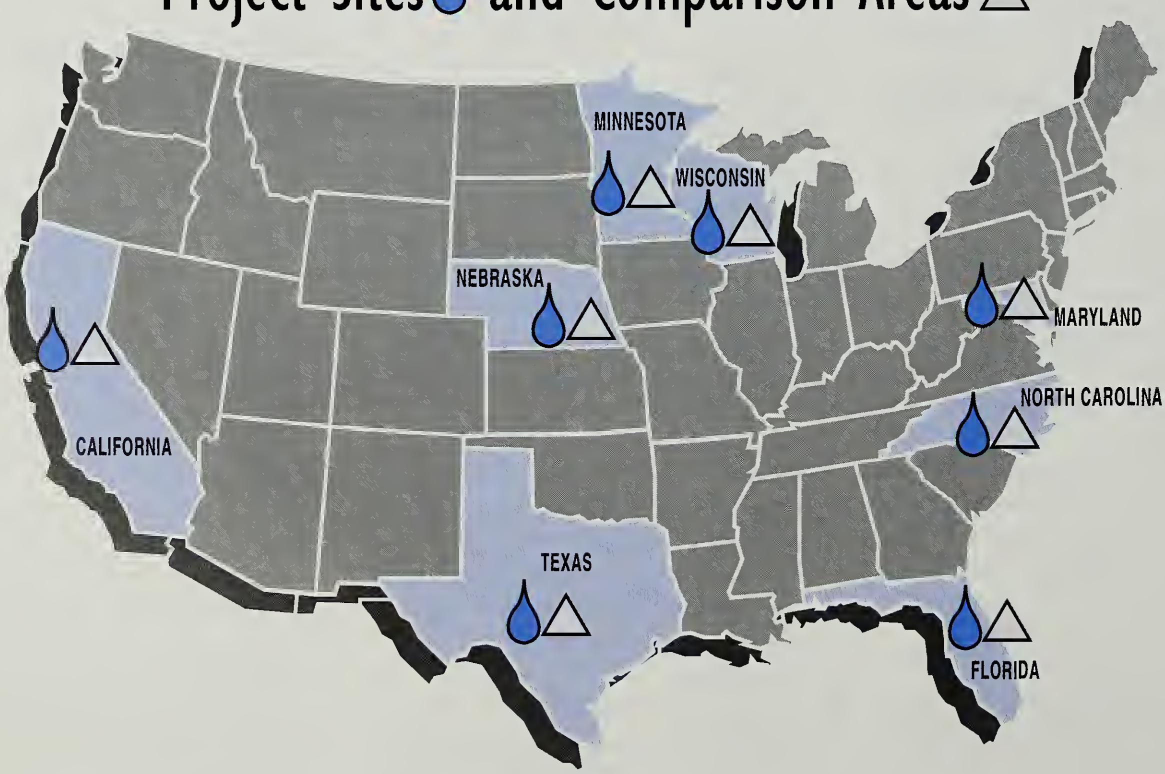

Figure 1. Location of Water Quality Demonstration Projects and Comparison Sites Begun in 1990

leadership in respectively providing education and technical assistance, with cost-share support for producer installations provided by FSA. Typically, the contributions of information transfer and education (I&E) are more salient at the early stages of the overall adoption process. Technical assistance and cost sharing tend to become more important later, facilitating the "trial" and "use" stages of the adoption process (Figure 2).

The geographic areas of the 1990 demonstration projects vary in size from a portion of only one county, in one of the eight states, to county or multi-county areas in the other seven states including a dozen or more contiguous counties in two of the states. Collectively, the projects reflect a wide range of crop and livestock agricultural production practices, as well as agronomic, hydrologic, social, and political situations. The focus of the projects has been to accelerate the voluntary adoption of both currently available and proposed practices that are cost-effective for producers and that protect the quality of surface water and groundwater.

It was intended that recommended agricultural practices that protect/improve water quality be adopted by those who produce agricultural commodities *for profit*. The demonstration projects have attempted to persuade producers, including those working under severe resource constraints, to adopt project-promoted practices. Limitations in the profitability of an agricultural practice generally limit the rate of its adoption.

Included in the demonstration projects have been (a) innovative practices requiring significant information transfer as well as technical and financial assistance, and (b) practices more familiar to producers, requiring strategies to address any negative assessments of these practices, as well as other barriers to their adoption. The projects collectively have used various approaches within their respective social, agronomic and physical settings. All of the projects have used a variety of communication and educational techniques to elicit agricultural producers' consideration of information about project-recommended practices. All projects have included producer/project staff demonstrations of the use of the recommended practices on selected farms or ranches (i.e., on-farm/field demonstrations).

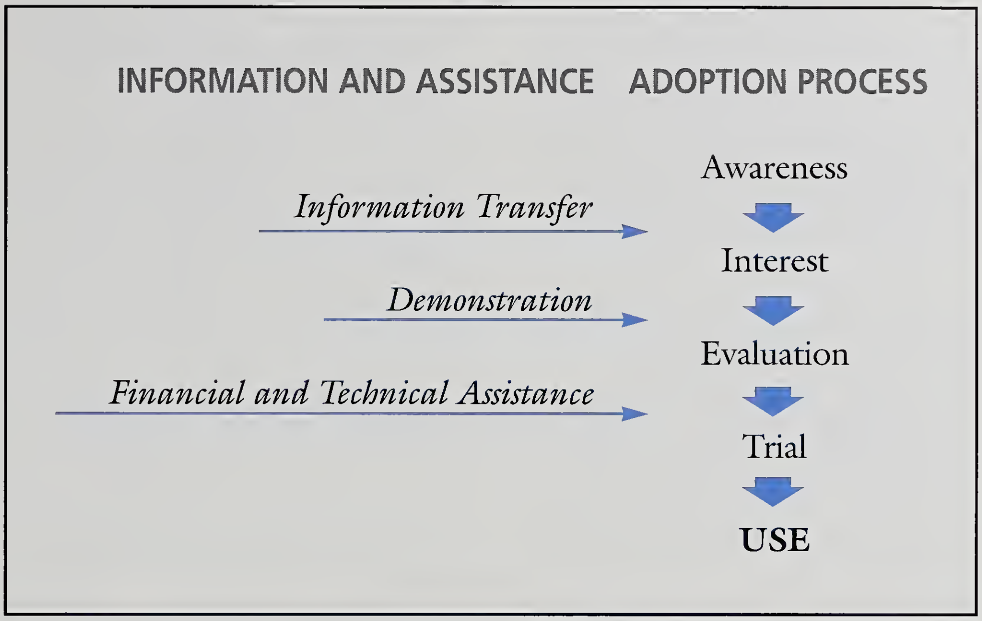

Figure 2. Information and Assistance Related to the Adoption Process

The Field Demonstration Approach

On-farm/field demonstrations have been a defining characteristic of the work of Cooperative Extension and various USDA agencies for decades (Gilbertson and Gallup 1957). On-farm demonstrations compare the effectiveness of two or more agricultural production methods (Roger and Leuthold 1962), and generally involve cooperation between an agency/organization and "host farmers." The generally accepted rationale behind demonstrations is that they are more convincing as to what works in local situations than generalized research reports, experimental farm findings, and commercial marketing claims.

Test demonstrations differ from *result* demonstrations. While terminology varies, test demonstrations generally follow the research and development that produces innovative practices and technologies. A test demonstration provides *trial* of a practice or technology on a limited scale within a given site-specific environment (Glennan, Hederman, Johnson, and Rettig 1978). A result demonstration promotes the adoption of a practice or technology already proven to be generally effective, or effective in one or more site-specific environments. Demonstrations may begin as test demonstrations and end as result demonstrations.

The term test-demonstration is used here in the same way that "on-farm research," and "research-demonstration" are used, in pointing to project demonstrations conducted by farmers, or in collaboration with farmers, under ordinary farm conditions—rather than conducted on research farms operated at public expense (Hancock 1992).

Factors found to be associated with the success of field/on-farm demonstrations in assisting selection among practices for use on a broader scale include: suitability of the BMP for use in the site-specific situation; type and

degree of farmer involvement in the demonstration; target audience accessibility to the demonstration across time and space; and degree to which the host producer and his/her farm represents the surrounding farming community and agricultural situation.

Accountability for Project Processes and Results

The USDA Water Quality Program Plan (1989, 21) called for a 1991–94 evaluation of the performance and effects of the first eight demonstration projects. As mentioned above, the call was for an evaluation of the "extent that improved practices are adopted by producers in each area, the costs of implementation, and the environmental improvements obtained as modified production systems are implemented."

The USDA Agencies collaborating to launch the demonstration projects, together with USDA's Economic Research Service, agreed to collectively provide for overall external evaluation as well as agency reporting on the effectiveness of the 1990-initiated demonstration projects (Tidd and Weber 1990). The evaluation and reporting components include:

- an *external assessment* of 1990 projects' initial organization and implementation over their early months of operation (Rockwell, Hay, and Buck 1991);
- a summary of *project staff reporting* on project participants' 1991–94 adoption of recommended practices, as well as these projects' estimates of their potential and actual impacts on water quality (Meals, Sutton, and Griggs 1996);
- the present, *external evaluation* of the projects' 1991–94 involvement of producers and their 1992–1994 impacts on processes of producer adoption of recommended water quality practices; and
- an economic assessment of selected projects' cost-effectiveness and cost-benefits.

The USDA Water Quality Program Plan (1989, 21) charged the demonstration projects to demonstrate "how *quickly and effectively* producers can modify their ... practices to reduce the movement of agri-chemicals and waste products through soils and potentially to groundwater and surface water." This evaluation examines how quickly agricultural producers in the demonstration project areas modified their practices—through measuring the rate at which producers adopted project-promoted practices during 1992 and 1993. These two years may be considered, *for most* of the demonstration projects, the *first two years of full implementation* of all project components. At least two projects, including Florida and Minnesota, elected to defer some of their information transfer and education (I&E) activities until obtaining field demonstration data. Thus, these projects' I&E work became fully operational beginning no earlier than 1993.

The end of FY 1990 and much of 1991 were required for project development, including recruiting demonstration producers and setting up demonstrations. For most of the projects, the final portion of FY 1991 saw transition—from emphasis on project organization and development, staff recruitment and training, and recruitment of field demonstration cooperators—to full implementation of project activities with targeted audiences (Rockwell, Hay, and Buck 1991). The first two years of "full operation" of the projects were based on the first four years of USDA funding to the projects (1990–1993).

The rates of adoption of the project-promoted practices—i.e., best management practices (BMPs)—reflect the economic, environmental, and social acceptability of these project-promoted practices to agricultural producers. They also reflect how effective the demonstration projects are in getting producers to consider and adopt the BMPs—through informing, educating, and assisting producers technically as well as financially. The findings of this evaluation are interpreted to enhance understanding of factors contributing to the success of current and future water quality program efforts.

Model and Measurements for the Evaluation

The structure of this evaluation is based on a comprehensive model of demonstration, communication, and adoption processes (Ervin and Ervin 1982). The model is employed to help describe and interrelate those factors important to producer usage of best management practices (BMPs) designed to protect and improve water quality.

Included in the model as predictors of adoption are a range of institutional, producer, and communication characteristics. The components of the model, and some of the types of variables within them, are identified in Figure 3. The model, as depicted, is adapted to the factors examined in the early 1992 survey and the early 1994 survey of producers on which this evaluation is based.

Qualitative Measures

The components of the model (lower left of Figure 3) labeled (a) "*Institutional Factors*" et cetera, and (b) "*Demonstration Projects/Communication Campaigns*" both concern effective planning and management of the demonstration projects. This evaluation examined variables within these components via *qualitative data.*

The qualitative data included, for example, the extent to which the projects: (a) originally possessed substantive, locally validated information to support project claims of benefits from using project-promoted practices; (b) had recruited respected community members to cooperate in con-

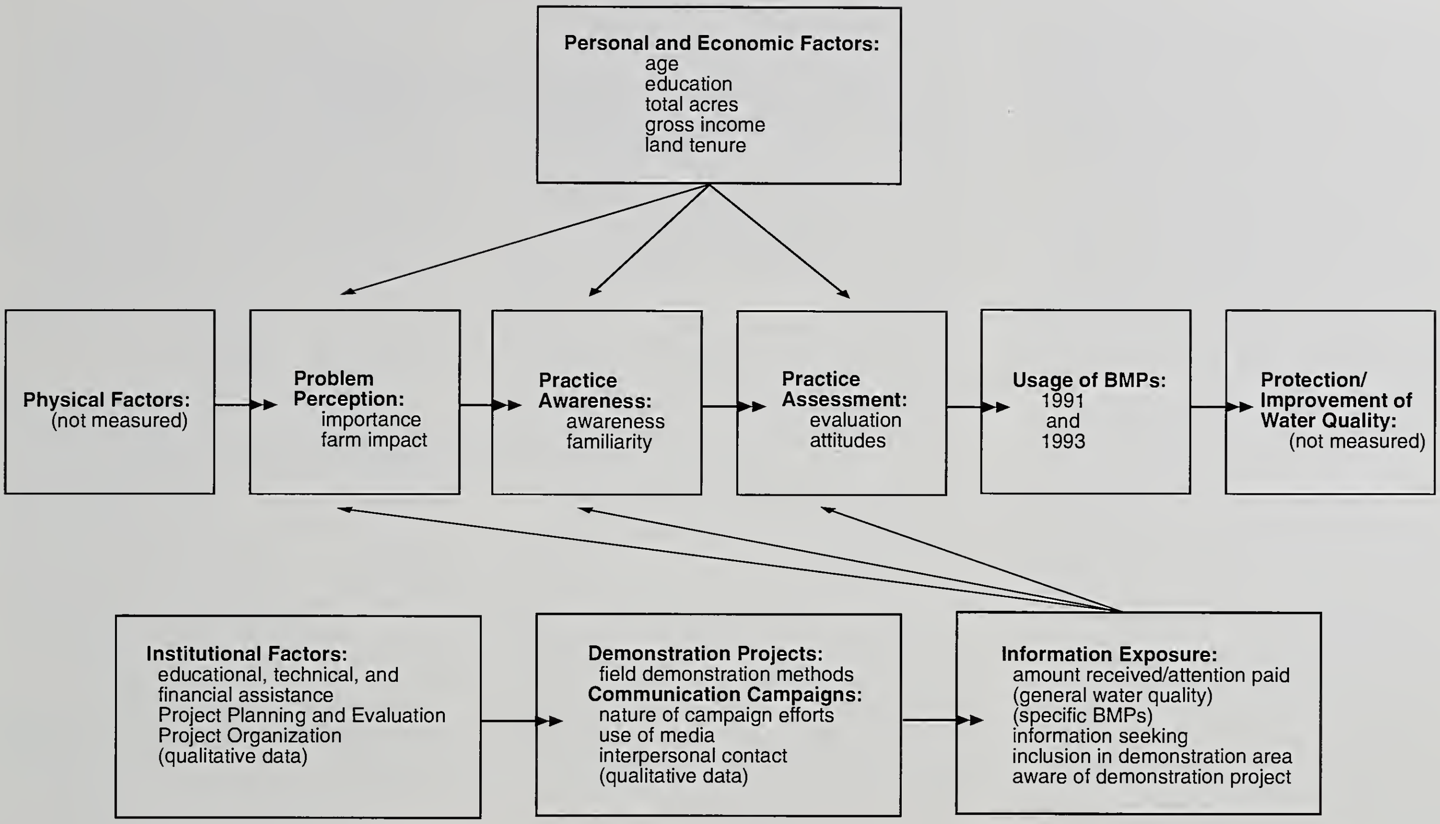

Figure 3. Components of the Ervin and Ervin Adoption Model

ducting field demonstration activities; (c) had qualified communications personnel contributing their expertise to project efforts; (d) had segmented producer audiences according to their farm management and communication needs; and (e) used public media to build problem and solution awareness. Also examined qualitatively were general program attributes, such as extent of pro-active project planning, clarity of project objectives, and extent of interagency communication.

Quantitative Measures

Whether the surveyed producers had farming operations in the demonstration areas, or in matched comparison areas that were located nearby the demonstration areas, was represented by quantitative data, while other "*Information Exposure*" data (Figure 3) are producers' self-reported, perceptual, quantitative ratings. "*Problem Perception*" data, referring to producers' assessments of the seriousness of water quality problems, are also self-reported, perceptual data. Measures of "*Personal Factors*" and "*Economic Factors*" are likewise self-reported, quantitative data.

"*Physical Factors*" refers to the extent of water pollution potential of a producer's land, and "*Protection/ Improvement of Water Quality*" (Figure 3) refers to contaminant loadings to water resources and trends in the quality of lakes and streams, aquifers, and water wells. "Physical Factors" and "Water Quality" were not measured in this evaluation, due to the high cost that such measurement would have entailed.

The process of adoption of a new practice (Rogers 1995) includes producers: (a) becoming *aware* of the new practice, (b) obtaining information about it to the extent of their *interest* in it, (c) *evaluating or assessing* the practice for possible use, (d) *trying out the practice* on a small scale, and (e) moving to full-scale *use* of the practice, i.e., *adopting* it. The measures of these adoption processes are self-reported, perceptual, *quantitative data* regarding producers' steps toward adopting each of a sample of BMPs which have been promoted by the demonstration projects.

The measurement of "*Practice Awareness*" is whether or not the respondent was at all aware of a recommended BMP at the time of the survey. For example, one of the questionnaires asked, "Prior to now, were you aware of irrigation scheduling?" "*Practice Familiarity*" was measured using a five-point rating scale of how knowledgeable producers believed themselves to be about the BMP, with questionnaire response categories of: "unfamiliar, somewhat familiar, mostly familiar, and completely familiar." Familiarity with a practice is a necessary, but not a sufficient condition, for its adoption.

"*Practice Assessment*" includes producers' perceptions of the profitability of the recommended BMP in their own farming operations. "Practice

Assessment" was measured by producers' ratings of each of nine characteristics concerning each of the designated practices, i.e., nine advantages/disadvantages that producers might perceive in considering the use of these practices, based on their experience with them or on observations of use by others. Producers in the sample survey were asked to evaluate each of the designated BMPs, even if they did not use them or knew little about them.

The measure of "*Best Management Practice Use*" was whether producers reported ("Yes" or "No") using the practice in "the most recent applicable growing season" (1991 in the baseline survey, and 1993 in the final survey). Collectively, the above measures probed the specific nature and circumstances of producers' awareness, knowledge/familiarity, assessment, and usage of the sample of BMPs designated for tracking by this evaluation.

Design and Conduct of the Evaluation

This evaluation views the model's above-mentioned "*institutional factors*" and "*demonstration projects/communication campaigns*" as project *effort components.* These efforts include organizational, planning, and implementation aspects focused on achieving overall project effectiveness.

Qualitative Data on Project Efforts

Staff leaders for and selected members of the eight water quality demonstration projects were interviewed on-site regarding the nature, type, and extent of the 1991–94 efforts of their respective projects. Personal interviews were conducted first in 1991, and then again in 1995. (The 1995 interviews required project personnel to search their memories when responding to interviewer questions). Interagency demonstration project reports submitted to USDA headquarters provided additional details.

Interview data were utilized to: (a) provide feedback to project staff, with intent to enhance the effectiveness of subsequent demonstration project efforts; (b) guide planning of the quantitative surveys in order to evaluate project effectiveness; and (c) help interpret the findings of the surveys.

The interviews focused on the field demonstration, and the information transfer and education (I&E) components of the projects. The on-site interviews conducted in 1991 probed for data on the individual projects' multiple communication methods, ranging from interpersonal contacts through mass communications. These communication methods were used to promote the consideration and use of project-promoted BMPs, as well as to publicize project demonstration activities. The interviews conducted in 1995 clarified, enhanced, and updated the data collected on the range, extent, evolution, and interrelations of the procedures and methods employed by each project.

Quantitative Data on Adoption Processes

During 1991, the evaluators obtained from lead staff of each of the eight projects descriptions of the BMPs chosen for recommending for adoption by producers. For the sake of economy, a *subset/sample* of the BMPs being promoted was selected for adoption process measurement.

This subset, selected in consultation with project managers, included some of the project-promoted BMPs that were of highest priority, as planned by their respective demonstration projects.

Thirteen project-promoted BMPs were selected for tracking by this evaluation. These BMPs varied in their requirements for extent of managerial expertise, labor, capital investment, and risk, although most require high managerial and/or labor inputs. The BMPs selected focused on soil nutrients, irrigation, animal wastes, and weed management. The selected BMPs were analyzed technically to allow accurate characterization and survey measurement of producer adoption of the BMPs. The designated practices were categorized, according to those of their characteristics that could be generalized across sites, by an expert technical committee supporting the evaluation.

The specific BMPs selected at each site are identified in Figure 4, showing that some of the same BMPs were selected within several projects. Each designated BMP (duplicated or unduplicated) in the projects is counted as a BMP case. A total of up to 28 BMP cases is included in the analyses performed in this evaluation.

Drafts of the survey questionnaires for producers were reviewed by staff at USDA headquarters and by state project staffs, for technical accuracy as well as appropriate language and format.

Sample producers for the surveys were selected using *spatial*, i.e., *lattice, sampling* techniques to avoid potential biases associated with mailing list sampling techniques. Individual fields randomly sampled from aerial photos were the unit of analysis. Sample producers were selected on the basis of field ownership (Figure 5).

Careful computations of optimal producer sample size—to represent producer populations at each demonstration and comparison site—were conducted, to allow statistically valid comparisons of change both over time and between the demonstration and comparison sites. Acceptable ranges of statistical power indices were used. (The purpose was not to draw samples to generalize to all producers at a given site, as is the case in some sample surveys, but to allow for comparisons among given commodity groups of producers).

The sample surveys used a variation of the Dillman Total Design Method for questionnaire preparation and mail distribution (Salant and Dillman 1994). This method requires careful

BMPs Grouped by Characteristics	STATE OF PROJECT IMPLEMENTATION							
	CA	FL	MD	MN	NE	NC	TX	WI
Group A: Low Capital, High Management, and High Potential Divisibility.								
1. Nutrient Budgeting: Manure Crediting			X	X		X		X
2. Nutrient Budgeting: Legume Crediting			X	X	X			X
3. Nutrient Budgeting: Use of Soil Tests					X		X	
Group B: High Labor and Management, High Potential Divisibility.								
4. Split Application of Nutrients		X	X	X	X	x	X	X
5. Soil Moisture Testing/ Watertable Monitoring		LS						
6. Irrigation Scheduling		X		X	X			
7. Testing for Irrigation System Uniformity/Efficiency		LS						
Group C: Project-Specific BMPs								
8. Tailwater Recirculation System	LS							
9. Gravity Tailwater Recapture System	LS							
10. Static Irrigation System	LS							
11. Float Valve System		LS						
12. Brush Management—Prescribed Burning							LS	
13. Farmstead Assessment System								LS
	4	4	3	4	4	2	3	4

(BMP cases — Total equals 28)

KEY:
X = BMP central to several projects — selected by evaluators
x = BMP to receive some attention by project (not central) — selected by evaluators
LS = Locally-selected BMP used by this evaluation

Figure 4. Selected BMPs and Their Characteristics by State

attention to the visual accessibility and attractiveness of the questionnaire to survey respondents, as well as use of multiple mailings to improve response rate. A respondent tracking system traced questionnaire returns over the multiple waves of interviews.

A sample survey regarding the varied crop/livestock clusters of BMPs was collected in each of the eight sites. Sample sizes projected for the survey were based on needs for statistical inference regarding area level analyses. However, the size of the samples of respondents regarding adoption of BMPs for vegetable production in Florida, and BMPs for poultry production in North Carolina, were too small to be used in the analyses.

The following types of quantitative, self-reported survey data from producers were collected:

- Producers' socio-economic characteristics; their uses of channels of agricultural production information and channels of information about how to protect water quality; and their perceptions of the importance of water quality problems (1992 baseline survey and 1994 final survey).
- Producers' awareness of their area's demonstration project and its field demonstrations activities, and ratings of project personnel performance (1994 final survey).
- Baseline survey of extent of producers': awareness of and familiarity with each of a sample of the BMPs selected by the projects for promotion to producers; assessment of the advantages and disadvantages of each of these BMPs, and; use of each of these BMPs in 1991 (the 1992 baseline survey retrospectively measured BMP use during 1991).
- Final survey of extent of producers': awareness of and familiarity with the same sample of BMPs; assessment of the advantages and disadvantages of these BMPs, and; use of these BMPs in 1993 (the 1994 final survey retrospectively measured BMP use during 1993).

Evaluation Designs

Evaluation of the early effectiveness of the demonstration projects is approached via two separate but related evaluation designs. Project effectiveness in accelerating adoption of the project-promoted BMPs at *the project area ("watershed") level* is evaluated through use of quasi-experimental evaluation design and analysis. Project effectiveness at *the individual agricultural producer level* is evaluated through use of cross-sectional design and analysis.

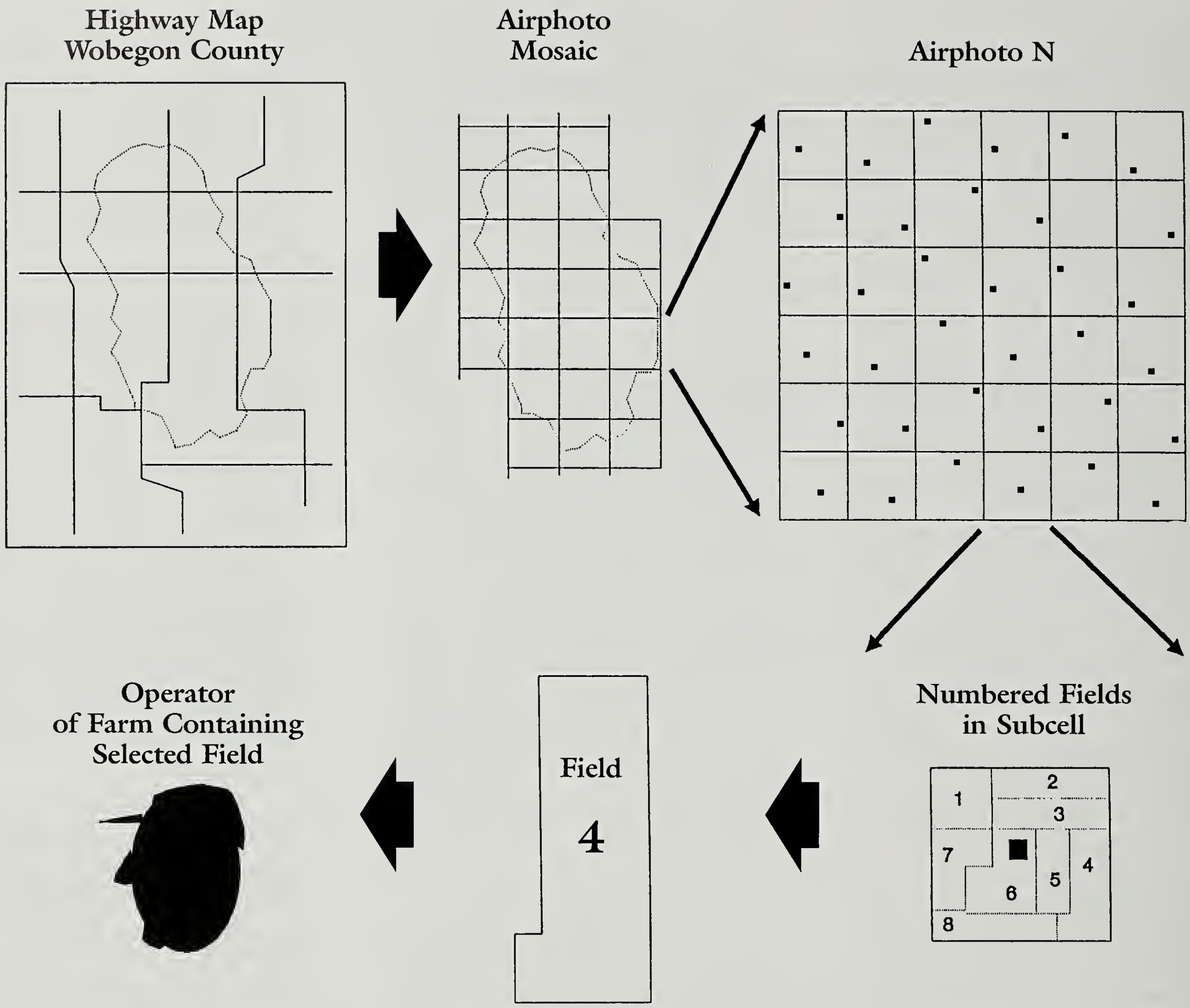

Figure 5. The Spatial Sampling Process for the Communication and Adoption Evaluation

1. Effectiveness at the Project Area Level

The geographic areas, i.e., "watersheds," selected for each of the demonstration projects contained known current and/or future water quality problems or risks that were agriculturally-related. An underlying evaluative question is as follows: "Can educational, technical and financial assistance demonstration projects lessen water quality problems/risks *across an entire project area*?"

The above question leads to a follow-up question about the type and magnitude of the projects being conducted by USDA and its state cooperators: "Can such projects accelerate adoption of water quality practices among producers *on average in the demonstration project area*?" If *average* adoption rates can be speeded up across a whole area, then there may be a basis to expect that the projects can lessen *watershed* water quality problems/risks.

It is essential to recognize that the *average* adoption rate in a demonstration area represents a combination of the adoption rate by producers who *had been* (directly and/or indirectly) exposed to the local demonstration project (Figure 3) as well the rate by those who *had not been* exposed, i.e., those who had and had not received project information, education, technical assistance and/or financial assistance.

This evaluation's area-level, quasi-

experimental design examined (a) producer adoption behavior within seven of the eight demonstration areas relative to (b) producer adoption behavior within nearby matched geographic comparison areas. (In California, no matched geographic comparison area could be established). Comparing changes on adoption variables between the demonstration areas and their matched comparison areas—where "normal rates of adoption for the overall geographic area were expected to occur"—allows identification of specific *impacts* of the projects. Were there statistically significant increases in adoption processes within the demonstration areas, between early 1992 and close of 1993/early 1994? Were adoption variables at statistically higher levels within the demonstration area than in their respective comparison areas, by early 1994?

It was initially planned to conduct surveys of producers over three time periods between early 1992 and early 1995, in both the demonstration areas and the comparison areas. The baseline survey in the demonstration areas and their respective matched comparison areas was conducted early in 1992, with a response rate averaging approximately 70 percent across all the areas. In early 1994, the demonstration areas and comparison areas were re-surveyed, including those individual producers who responded to the 1992 baseline survey. The overall, usable, producer response rate to the 1994 survey averaged approximately 64 percent of the respondents to the baseline survey, with such response rates as high as 70 percent in some of the areas.

The intended third data collection wave proposed for 1995 was not carried out due to budgetary constraints. This constraining of the initial design reduced the ability to implement the full suite and duration of analyses intended.

In summary, the area-level evaluation compares producer adoption processes within the areas of the demonstration projects and nearby matched comparison areas. This evaluation design helped to determine whether producers made changes on adoption variables in the demonstration areas alone, or in the comparison areas as well. Surveys of representative groups of producers were conducted in early 1992 and early 1994, both in the demonstration areas and the comparison areas. Comparing adoption processes between the demonstration areas and their respective matched comparison areas was designed to help identify any specific *impacts* of the projects.

2. Effectiveness at the Individual Producer Level

A second approach to evaluating demonstration project effectiveness examines associations among characteristics of individual agricultural producers and adoption processes regarding project-promoted BMPs (Figure 3).

First, this approach examines whether there is a simple (bi-variate) correlation between (a) producers' *awareness (early in 1994) of the demonstration project* in their geographic area and (b) producers' recent (1993) *exposure to information about specific BMPs* that have been promoted by that project. Awareness of the demonstration projects by 1994 is selected as a proxy measure for having participated in project activities, e.g., through reading project materials and/or attendance at farm demonstrations held by the project. *On balance, individual producers who have become aware of the demonstration projects may be expected to have generally higher exposure (Figure 3) to project information and education.*

Second, the analysis examines whether producers who were *aware of the project* in their area were also more *aware of, more familiar with, and more likely to be users* of the designated subset of project-promoted BMPs.

Third, the analysis examines whether there are correlations among producers' (a) recent *exposure to information* about specific project-recommended BMPs, and (b) their *awareness of, extent of familiarity with, favorableness toward, and use of* these BMPs, as ascertained by the 1994 Final Survey.

The above simple correlations can *suggest—but not confirm*—whether there is *demonstration project influence* toward speeding BMP adoption. These bi-variate correlations are only suggestive because they do not take non-project factors into account.

Therefore, a next step in this approach is to employ analysis via partial correlations. Partial correlations help identify to what extent each producer characteristic (including relation/lack of relation to the demonstration project) explains usage of project-promoted BMPs. Partial correlations help identify the relative strength of influence of numerous producer-related factors, as they are considered simultaneously in predicting producer use of project-promoted BMPs. For example, in predicting the use of a BMP, the strength of influence of the producer's attention to specific information about the BMP is compared with the producer's personal and economic characteristics.

Both the simple and complex correlation analyses are cross-sectional, i.e., they do not explicitly follow adoption processes over time. Lack of time sequencing in the analysis limits assurance that measured outcomes are influenced *by* the demonstration projects rather than *by factors associated with* the projects.

Quantitative Evaluation of Project Results

Baseline Findings

Findings from the baseline survey, conducted early in 1992, help to describe the "context" in which the demonstration projects were initiated. The baseline data indicate extent of producers' pre-project (a) concerns about water quality; (b) overall exposure to information about what producers can do to protect water quality; and (c) use of channels of information about agricultural production practices including those which affect water quality. The baseline data also indicate producers' extent of prior use of the selected subset of the practices that the demonstration projects had chosen to recommend to producers for their consideration and adoption.

Baseline findings are analyzed from the 905 useable producer responses to the baseline survey. The producer populations and their respondent sample sizes varied across the eight sites. For the eight individual *demonstration* areas, average sample sizes was as follows: median—64 respondents; mean—78 respondents; and mode—between 60 and 70 respondents. Range was from 42 to 119 respondents. For the six useable individual *comparison* areas (all but California and Florida projects), average sample size was as follows: median—40 respondents; mean—56 respondents; and mode—between 20 and 30 respondents. Range was from 18 to 143 respondents.

Tests of the significance of survey findings were based upon the differing numbers of respondents and data distributions particular to a given area. Thus, areas with smaller numbers of sample respondents can be compared with those having larger numbers, in terms of whether any differences in survey findings were statistically significant.

In the early 1992 baseline data, few statistical differences were found on adoption variables between the demonstration area producers (on average) and their respective comparison area producers (on average). *There was only one difference between demonstration areas and comparison areas for every ten comparisons, out of the total 60 comparisons on BMP awareness, familiarity, and use variables. This indicates nearly initial equivalence between demonstration area producers and comparison area producers regarding the project-promoted BMPs.*

Thus, findings from the early 1992 baseline survey are based on analysis of the demonstration area data and comparison area data combined. Findings on the combined demonstration area and comparison area within a state are referred to as "site" findings.

Several consistent findings emerged across the eight sites regarding producers' views about water quality and their communication behaviors. These refer to key components of the previously described model of adoption (see Figure 3).

Context of the Demonstration Projects

Exposure to Information about Protection of Water Quality

Nearly all producers had heard or read at least something over the previous year about specific things they could do to help protect water quality. Most producers reported considerable exposure to the topic (Figure 6), and nearly all said they paid at least some attention to information about water quality protection. Most producers indicated a need to receive more such information.

Channels by which producers received information about how to protect water quality varied in importance:

- the *most frequently mentioned channels* carrying information on water quality were farm-specific media, including farm magazines, newspapers, newsletters, and broadcasts;
- extension and conservation service agents, and other government and university sources, generally followed; and local staff of agencies with soil and water conservation responsibilities were the most mentioned sources *for finding out about the nature and extent of water quality problems in one's local community*; and
- commercial sources such as farm supply dealers received least mention as communication channels for water quality information.

To place the above findings in context, it is helpful to understand that for their agricultural production decisions, producers used a wide range of information channels for different purposes:

- the channels of information that producers used most *for making overall decisions about their farm operations and day-to-day decisions* included general farm magazines, farm newspapers, commercial farm contacts, and family members/partners;
- farm magazines and newspapers also clearly dominated as the most useful channels *for initial awareness of (or "first hearing about") new farm practices*; and
- *for information on the local performance of practices*, other producers were viewed as the most important source of information. Extension publications/agents, and also demonstrations/field

days, vied with general farm magazines for second place in frequency of mention.

- *for learning how to implement farm practices*, other producers were seen as the most important information channel at this stage of the decision process. Attending demonstrations and field days, using farm magazines, commercial representatives, and Extension agents appeared in a second tier of sources.
- *channel preference varied with the practice involved.* For example, by far the most mentioned channels *for choosing agri-chemicals for plant nutrient and pest management practices* were commercial agri-chemical dealers, with independent consultants a significant factor in some states. Extension agents and publications followed. *But, for choosing appropriate on farm-based practices* (e.g., manure crediting), Extension agents were the first-rated channel of information.

Differences in these overall findings among the eight demonstration areas and their comparison areas likely depended upon availability of various information channels, types of producers, and the kinds of practices being examined (Figure 6).

Perception of Water Quality as a Problem

Producers saw water pollution as *less serious close to their own farms*, but as more serious at state and national levels:

- nearly three-fourths of the respondents regarded water pollution as a serious problem nationwide, less than half of them viewed it as serious in their own state, and less than 10 percent saw it as serious on their own land;
- about half the respondents saw *farmers as having little or no impact* on water pollution, whether close to home or nationally;
- more than 50 percent of the respondents believed farm practices have *no impact on water quality in their respective communities*, with fewer than 25 percent acknowledging any such farm practice impact.

However, *over two-thirds of the producers agreed that:*

- producers have a great responsibility to protect water quality in their communities;
- remedial practices are readily available to agricultural producers; and
- producers will be required, through legislation and regulation, to use remedial practices if they do not use them voluntarily.

Baseline Stages of Adoption

Several findings characterize the baseline data regarding stage of adoption of the specific BMPs *designated for this evaluation.*

Awareness of the BMPs

An average of more than three-quarters of the producers reported themselves already aware of the designated BMPs promoted by their respective projects. Lower percentages of producers were aware of the farmstead assessment system in Wisconsin (Figure 7), split application of nitrogen fertilizer in Texas, and irrigation scheduling in Minnesota. These three practices are examples of where promoting a broader awareness of BMPs might have been a logical first step for the respective demonstration projects.

Familiarity with the BMPs

Given the generally high rates of awareness of the sample of BMPs prior to their being recommended by the demonstration projects, it is

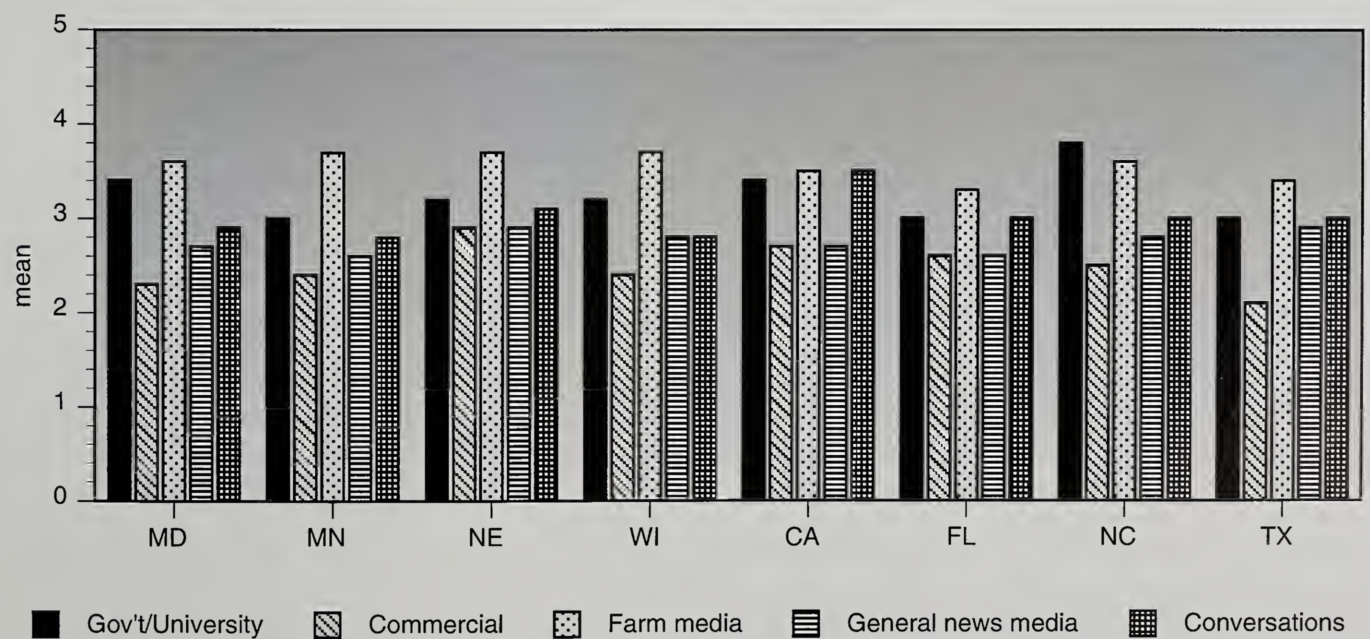

Figure 6. Frequency of Use of Channels of Information by State, 1992

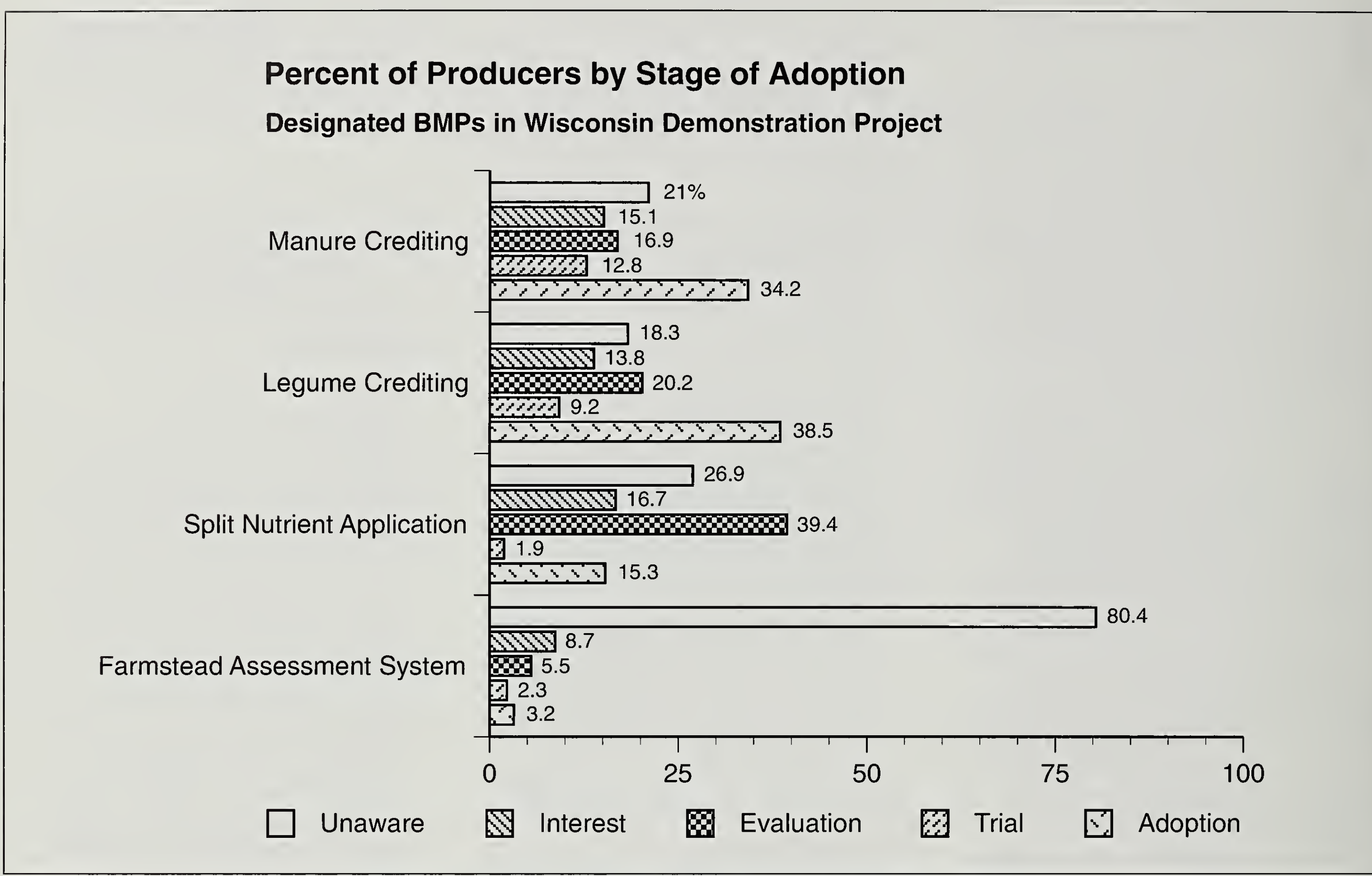

Figure 7. Wisconsin Baseline Stages of BMP Adoption, 1991–92

apparent that *a strong majority of producers were already in the interest/information seeking stages of the adoption process* regarding application of the following practices: split application of nitrogen in the projects of Maryland, Minnesota, Nebraska and Wisconsin; legume crediting in Maryland and Minnesota; manure crediting in Minnesota and North Carolina; deep soil nitrate testing in Nebraska; and the four rice irrigation systems in California.

Producers reported moderate familiarity (an average of a little over three on the 5-point scale) *with the designated BMPs recommended by their respective project.* In such a situation, a productive strategy to promote adoption might have been to find out specifically how much producers actually know about the BMPs, as well as how they assess them, and use this information to select additional agronomic and economic information for transferring to local producers.

Assessments of the BMPs

The strong majority of the producers who were already aware of, and to some degree familiar with, the designated practices indicated a wide range of attitudes toward them. Respondents' assessments of the specific BMPs were mixed, with broad differences across practices as well as sites (Figure 8).

A notable proportion of producers could not assess the practices either positively or negatively, i.e., responses to the assessment items often ranged between 20 and 30 percent "don't know." Percentages provided in Figure 8 represent distributions of responses to one or more response categories of the appropriate items. For example, the percentage opposite "practicability" in Figure 8 reflects the responses to both the response categories "practical" and "very practical."

In one cluster of BMPs having similar producer ratings, a majority or bare majority of producers in all the applicable sites viewed legume crediting, manure crediting, and irrigation scheduling as *increasing profitability.* However, *sizeable minorities of producers in some of the sites had reservations about whether using these practices increases producers' profits.* These three practices were also generally seen as inexpensive, not complex or difficult, low risk, and easy to get information about. Yet, only about half the producers in these sites rated these three BMPs as "practical" or "very practical." A third to a half of producers across applicable sites saw these practices as improving water quality.

California

(4 BMP cases)	Tailwater Recir. System	Gravity Recapt. System	Static Irrig. System	Float Valve System
Expense (moderate/high)	89%	41%	44%	41%
Complexity (complex/very)	34	27	21	19
Difficulty (difficult/very)	15	7	8	7
Practicality (practical/very)	54	18	20	23
Risk (medium/high)	20	13	21	13
Profitability (increase)	25	13	7	5
Farm Water Quality (improve)	36	20	21	10
Community Water Quality (improve)	44	32	29	23
Information Ease (easy)	64	52	49	44

Florida

(4 BMP cases)	Split Nut. Applic.	Soil Moist. Test	Irrig. Schedul.	Irrig. Syst. Test
Expense (moderate/high)	54%	16%	19%	14%
Complexity (complex/very)	12	10	7	6
Difficulty (difficult/very)	6	6	7	4
Practicality (practical/very)	67	47	66	57
Risk (medium/high)	6	9	8	9
Profitability (increase)	46	42	51	44
Farm Water Quality (improve)	35	22	31	24
Community Water Quality (improve)	44	27	32	29
Information Ease (easy)	47	39	39	39

Maryland

(3 BMP cases)	Manure Credit.	Legume Credit.	Split Nut. Applic.
Expense (moderate/high)	10%	12%	44%
Complexity (complex/very)	9	7	20
Difficulty (difficult/very)	5	3	10
Practicality (practical/very)	44	48	29
Risk (medium/high)	5	3	15
Profitability (increase)	64	61	47
Farm Water Quality (improve)	32	30	35
Community Water Quality (improve)	38	38	39
Information Ease (easy)	37	34	58

Minnesota

(4 BMP cases)	Manure Credit.	Legume Credit.	Split Nut. Applic.	Irrig. Scheldul.
Expense (moderate/high)	11%	13%	41%	14%
Complexity (complex/very)	5	5	8	12
Difficulty (difficult/very)	2	2	2	7
Practicality (practical/very)	49	59	59	36
Risk (medium/high)	4	2	5	13
Profitability (increase)	69	71	65	52
Farm Water Quality (improve)	27	41	44	29
Community Water Quality (improve)	31	40	44	35
Information Ease (easy)	41	46	53	41

Figure 8. Producer Assessments of Thirteen Designated BMPs, 1992 (N=28 BMP cases)

Nebraska

(4 BMP cases)	Legume Credit.	Split Nut. Applic.	Irrig. Schedul.	Soil Nutrient Testing
Expense (moderate/high)	12%	65%	20%	21%
Complexity (complex/very)	14	35	16	8
Difficulty (difficult/very)	6	15	8	4
Practicality (practical/very)	45	22	56	67
Risk (medium/high)	15	48	16	7
Profitability (increase)	60	38	59	61
Farm Water Quality (improve)	37	48	45	57
Community Water Quality (improve)	39	48	45	51
Information Ease (easy)	46	56	52	61

North Carolina

(2 BMP cases)	Manure Credit.	Split Nut. Applic.
Expense (moderate/high)	30%	50%
Complexity (complex/very)	6	7
Difficulty (difficult/very)	10	5
Practicality (practical/very)	40	66
Risk (medium/high)	17	9
Profitability (increase)	53	45
Farm Water Quality (improve)	19	29
Community Water Quality (improve)	31	27
Information Ease (easy)	28	37

Texas

(3 BMP cases)	Split Nut. Applic.	Soil Nut. Testing	Prescribed Burning
Expense (moderate/high)	41%	23%	18%
Complexity (complex/very)	24	10	20
Difficulty (difficult/very)	9	5	16
Practicality (practical/very)	29	63	43
Risk (medium/high)	0	0	48
Profitability (increase)	50	76	76
Farm Water Quality (improve)	10	15	22
Community Water Quality (improve)	10	10	14
Information Ease (easy)	52	67	36

Wisconsin

(4 BMP cases)	Manure Credit.	Legume Credit.	Split Nut. Applic.	Farmstead Asses.
Expense (moderate/high)	10%	14%	42%	8%
Complexity (complex/very)	7	5	12	7
Difficulty (difficult/very)	3	1	11	3
Practicality (practical/very)	68	70	33	10
Risk (medium/high)	7	4	16	5
Profitability (increase)	76	75	46	13
Farm Water Quality (improve)	37	42	33	16
Community Water Quality (improve)	50	50	43	22
Information Ease (easy)	43	44	41	15

Figure 8 (continued). Producer Assessments of Thirteen Designated BMPs, 1992 (N=28 BMP cases)

Split nutrient application was viewed by two-fifths up to two-thirds of producers, in the applicable states, as requiring moderate to high expense. This practice was considered as profitable and practical by a majority or near majority of producers in the Florida, Minnesota, and North Carolina projects. However, split nutrient application was regarded as *less profitable and/or practical* in Maryland, Nebraska, Texas, and Wisconsin. A third to half of producers said this practice improved water quality, with Texas producers less likely to agree.

None of the designated practices selected for promotion in the Texas project were regarded by a majority of producers as particularly useful for improving water quality, although a majority to strong majority of producers called them profitable. On the other hand, none of the practices promoted by the California project were viewed as particularly profitable (Demonstration area producer adoption of these practices was likely due in part to regulatory pressure by the State of California for producer adoption of rice irrigation practices that would protect down-stream river water). Less than a majority of Florida citrus producers saw three of the four designated BMPs promoted there as profitable, and the remaining BMP was seen as profitable by a bare majority (51 percent).

In sum, *a majority or bare majority* of producers across the eight project sites viewed 15 of the 28 BMP cases as *increasing profitability*; sizeable minorities of producers *were unconvinced* that several of these 15 practices actually could increase their profits. And, *less than a majority* of producers viewed the other 13 BMP cases as "increasing profitability." A majority of producers viewed 12 of the 28 BMP cases as "practical" or "very practical." *Less than a majority* viewed the other 16 BMP cases as "practical" or "very practical." A bare majority of producers rated only three of the 28 BMP cases favorably as means to improving community water supplies.

At the time of initiation of the projects, obtaining BMP assessment data —of the type provided by Figure 8— could have been invaluable for developing project strategy to increase BMP adoption. A baseline BMP assessment of this type could have guided projects in formulating questions that their field demonstrations would need to answer positively to convince local producers of the merits of adopting the BMPs being considered for promotion/promoted by the projects. In turn, these answers would constitute part of the subject matter of project information transfer and education (I&E) efforts. Elaboration on the uses of BMP assessment data is provided in the recommendations section of this report.

Usage of the BMPs

Across all eight sites, *an average of about 25 percent of producers already were using the designated BMPs by the close of 1991* (the 1992 baseline survey measured producers' BMP usage retrospectively). Extent of usage varied considerably by BMP (e.g., see Figure 7).

Examples on the high side of the range of usage include: over 60 percent of the Florida project's citrus growers were at least in the trial stage of using the soil moisture test; over half of Minnesota and North Carolina respondents said they were using the practice of split application of nutrients; and a similar situation existed in Nebraska for irrigation scheduling. These situations typify cases in which the demonstration projects may have needed to identify and focus on those producers who had not advanced as far as the average toward adopting the recommended practices. The lower side of the range of prior usage (less than ten percent BMP usage) included: split application of nutrients in the Maryland and Texas projects; and manure crediting in the North Carolina project.

Project Effectiveness Findings

The approaches below to evaluating how quickly the demonstration projects became effective in influencing adoption of water quality practices are based on the survey questionnaires returned by random samples of producers in early 1992 and in early 1994. The final survey (early in 1994) data were collected approximately *three years after initiation* of the projects; and after *two years of full implementation* of the projects.

Data from the 1994 final survey show that producers who were aware of the projects reacted to them positively. Quality and relevance of project information were judged by participant producers to be from fair to good. Producers' ratings of their overall experience with project staff (employed by NRCS and Extension) also was from fair to good. Producers rated these Agencies and the demonstration projects highly, in terms of providing adequate staff time and numbers of staff.

Producer ratings of the demonstration projects were slightly less positive than their rating of NRCS staff, Extension staff, and FSA staff, in general. Evaluations of Agency staffs were based upon long-term experiences, while evaluations of the projects and their staffs were based upon relatively recent contact. Differences in ratings across states were minimal.

Factors Constraining Findings

Six factors may limit the degree to which project outcomes and impacts can be documented through this evaluation. The first is earliness of the final survey, including the one year *prematureness of the final (early 1994) survey.* As mentioned above, the third data collection wave intended for 1995 was not carried out due to budgetary constraints. This curtailment of the initial design reduced the ability to implement the full duration of analyses intended.

The second constraint is the *lessened project priority accorded to the sample of BMPs tracked* in this evaluation. While the BMPs selected for this evaluation were all promoted by their respective project(s) during 1991–94, the priority of about half the BMP cases was lowered from that of their initially high priority of 1991. A combination of factors involving project planning, organization, demonstration capabilities, and information and education strategies—and in at least one case weather conditions—led some projects to shift the BMPs they emphasized. In the Maryland, Minnesota, North Carolina and Texas projects, all of the BMPs selected for this evaluation were shifted to a lower priority during the time period of this evaluation. Wisconsin also lowered the priority of two of the four BMPs studied here. In all the projects, the initially chosen BMPs were promoted and demonstrated, but in the states noted above other BMPs received greater emphasis.

The third constraining factor is that *there may have been some failure in the operation of at least two of the comparison areas.* Comparing adoption rates in the demonstration areas and their respective comparison areas can identify project impacts at the area level—as long as comparison area producers are unaffected by project activities including evaluation activities.

Interviews with project staffs in 1995 suggest that adoption processes in the comparison areas of at least two states may have been affected by demonstration project activities. Project staff in these two states spontaneously mentioned the lack of sufficient separation of the comparison areas from their respective demonstration areas. Staff in one state indicated that some comparison area producers had requested and received project staff assistance, and that the demonstration area and its comparison areas were served by the same local newspaper. In the other state, staff commented that some producers from the comparison area (a) regularly crossed into a nearby demonstration area to attend demonstration project events and exchange information with farmers, and (b) received demonstration project information through staff of a state agency that has collaborated with the demonstration project.

The fourth constraining factor is that observed 1995 increases, both in project areas and comparison areas, in awareness of and familiarity with BMPs may have been inflated through "learning about" the BMPs through exposure to the baseline survey.

The fifth factor of constraint is that of *limited sample survey response rates in some of the sites.* A detailed description of actual sample size by site is presented in Nowak, O'Keefe, et al. 1996 (Vol. 1, 88–115; 131–142; Vol. 2, 33). In one case, unacceptably low numbers of respondents reflected a relatively small population of producers, i.e., Florida vegetable producers. In that case, respondent numbers in the comparison area did not allow adequate statistical comparison, as noted in the data presentations.

A sixth limitation is lack of findings on acreages of adoption and accuracy of adoption. That is, all producers, of whatever size of operation and BMP expertise, are weighted the same in the analysis of adoption processes.

Data from the 1992 survey and 1994 survey are analyzed in two ways—by area analysis and by individual producer analysis—to ascertain project effectiveness relative to BMP adoption processes.

Project Area Analysis

Evaluation at the demonstration area level is based upon the panel of 575 producers who completed questionnaires from *both* the early 1992 baseline survey *and* the early 1994 final survey. The average size of *a longitudinal* sample from the eight individual demonstration areas was as follows: median—36 respondents; mean—42 respondents; and mode—between 30 and 40 respondents. Range was from 19 to 92 respondents. The average size of *a longitudinal* sample from the six usable comparison areas was as follows: median—26; mean—41; and mode—between 20 and 30 respondents. Range was from 20 to 96 respondents.

The project area analysis measures adoption variables *"on average"* in the demonstration project areas and in the comparison areas. "On average" in the demonstration project areas refers to *average change* in adoption variables across (a) producers who *participated* in the demonstration project activities, i.e., those who received information/assistance directly from the projects, and (b) *nonparticipants,* i.e., producers who did not receive project information/assistance directly through project activities, and may not have received such information/assistance indirectly.

By early 1994, when the final survey was conducted, nearly one-half the producers in the demonstration areas are estimated to have been directly exposed, to some degree, to the demonstration project in their area. This estimate is based on a proxy measure of such exposure, i.e., producer awareness of the demonstration project in their area. In the demonstration areas of six states, between 44 and 51 percent of producers were aware of the demonstration projects in their respective areas. The project with the highest awareness had 72 percent producer awareness of the project, while the project with the lowest awareness had 30 percent producer awareness of the project.

The area analysis indicates the extent to which producers in the demonstration areas, *on average across those directly in contact with the projects, indirectly in contact, and not in contact,* made gains on the adoption variables over early 1992 to early 1994 (see Figure 3). Measurements were made of *changes* in producers': exposure and attention to, and seeking for agricultural information on protecting water quality; perception of

water quality as a problem; awareness of the individual BMPs in the sample of project-promoted BMPs; familiarity with these BMPs; favorableness toward these BMPs; and changes in usage of these BMPs, i.e., practice adoption. Tests were conducted of whether there had been *statistically significant increases in average BMP awareness, familiarity, assessment, and usage regarding each of the BMPs tracked from 1992 to 1994.*

Then, the area analysis examined whether any statistically significant increases for each BMP within the demonstration areas *were accompanied by statistically higher average awareness, familiarity, favorableness, or usage than in their respective matched comparison areas, by close of 1993/early 1994.*

Exposure to Information about Protection of Water Quality

The area analysis first measured the extent to which demonstration area producers (averaged across project participants and nonparticipants) increased their "overall exposure to water quality information" (Figure 3). This variable includes exposure to information of any type, and from one or more sources, on what farmers can do to protect water quality. Any such increase in exposure might heighten the probability of demonstration area producers' gains toward adoption of the BMPs promoted by the demonstration projects.

Hypothesis A: Demonstration area producers will become more exposed to information about water quality protection, increase the amount of attention they pay to it, and seek more information about water quality protection.

Demonstration area producers' perception of their amount of exposure to/attention paid to information about what farmers can do to protect water quality remained generally constant during the 1992–94 evaluation period. Likewise, demonstration area producers' tendency to seek additional information about how to protect water quality *remained generally constant* across the demonstration areas. However, information and attention levels were fairly high in all eight sites at the time of the baseline survey, leaving less possibility for increase.

A few changes in importance of channels by which area producers received information about protecting water quality were found over the two-year period. By early in 1994:

- producers *on average* continued to report, as they had in 1992, that the most important channel of water quality information was generally the farm press;
- Cooperative Extension, previously ranked second along with conservation services, became rated *more highly* as a water quality information channel in 1994 than in 1992, in two states; and
- in some project areas, family members and other farmers also became more highly ranked as channels of water quality information.

In most project areas, the general news media and commercial sources continued to receive lower ratings as channels of information on how producers can protect water quality.

Perception of Water Quality as a Problem

The area analysis next examined the extent to which demonstration area producers, on average over 1992–93, increased their "problem perception" (Figure 3), i.e., their view of the seriousness of water quality as a problem. Any heightened seriousness might increase the probability of average gains among producers toward adoption of the BMPs promoted by the demonstration projects.

Hypothesis B: Demonstration area producers' assessment of the seriousness of water quality problems will increase.

Little change was found in demonstration area producers' average ratings of water pollution as a problem, at the national, state, county, and farm levels. The proportion of producers viewing water quality as a serious problem close to home was as small in 1994 as in 1992. Nor did producers change their views about the role of producers in resolving any such problems. Thus, producers' views about the seriousness of water quality problems and farmer impact on water quality problems did not appear to change within the two-year period.

Awareness of the BMPs

Hypothesis C: Demonstration area producers' awareness of project-promoted BMPs will increase.

Hypothesis D: Producers' awareness of these BMPs will increase more in the demonstration areas than in the comparison areas.

Figure 9 depicts that 28 cases of potential increase in BMP awareness were evaluated across the eight demonstration areas (13 different BMPs). Twenty cases comparing demonstration area and comparison area gains in BMP awareness were evaluated.

- Demonstration area producers' percent awareness of the BMPs increased significantly in six (21 percent) of the 28 BMP cases.
- In no cases did BMP awareness in a demonstration area become significantly higher than in its matched comparison area.

In most of the 28 cases and in all eight states, measurable—but not necessarily statistically significant—increases were observed in awareness of the BMPs, between 1992 and 1994. *Demonstration area producers significantly increased their awareness of slightly* over *one-fifth of the BMPs* by the end of the first two years of full implementation of the projects. Potential increase in demonstration

area producers' awareness was limited in part by their generally high level of preexisting awareness of the designated BMPs. An average of over 75 percent of producers reported awareness of nearly all the BMPs at the time of the baseline survey.

Observed change in average percentage awareness of the project-promoted BMPs was about the same in the matched comparison areas as in the demonstration areas, for all 20 comparisons, by early 1994. In no cases did BMP awareness in a demonstration area become significantly higher than in its matched comparison area.

Familiarity with the BMPs

Hypothesis E: Demonstration area producers' familiarity with project-promoted BMPs will increase.

Hypothesis F: Producers' familiarity with these BMPs will increase more in the demonstration areas than in the comparison areas.

Figure 10 depicts that 28 cases of potential increase in BMP familiarity were evaluated across the eight demonstration areas. Twenty cases comparing demonstration area and comparison area gains in BMP familiarity were evaluated.

- Demonstration area producers' average familiarity with the BMPs increased significantly in 11 (40 percent) of the 28 BMP cases.
- In no case did BMP familiarity in a demonstration area become significantly higher than in its matched comparison area.

Demonstration area producers increased their familiarity with two-fifths of the BMPs by the end of the first two years of full project operation. Producer familiarity with most of the BMP cases increased measurably. Increases in familiarity that are sizable enough to be statistically significant were scattered across both the sample of BMPs and the individual demonstration project areas, but increases were more pronounced in the California demon-

STATE Best Management Practice	AWARENESS 92–94 DA	 94 DA/CA	STATE Best Management Practice	AWARENESS 92–94 DA	 94 DA/CA
California (4 BMP cases)			Nebraska (4 BMP cases)		
Tailwater Recirculation		na	Legume Crediting		
Gravity Tailwater Recapture	15*	na	Soil Nutrient Testing		
Static Irrigation System		na	Split Nutrient Application		
Float Valve System	18**	na	Irrigation Scheduling		
Florida (4 BMP cases)			North Carolina (2 BMP cases)		
Split Nutrient Application		na	Manure Crediting	15**	
Soil Moisture Testing	10*	na	Split Nutrient Application	10*	
Irrigation Scheduling		na			
Irrigation System Testing		na			
Maryland (3 BMP cases)			Texas (3 BMP cases)		
Manure Crediting			Soil Nutrient Testing		
Legume Crediting			Split Nutrient Application		
Split Nutrient Application			Prescribed Burning		
Minnesota (4 BMP cases)			Wisconsin (4 BMP cases)		
Manure Crediting			Manure Crediting		
Legume Crediting			Legume Crediting		
Split Nutrient Application			Split Nutrient Application		
Irrigation Scheduling			Farmstead Assessment	15***	

KEY:

DA	=	Percentage point increase in *demonstration area* producers' awareness of BMPs, 1992–1994 (N = 28 BMP cases; total 332 producers). Level of statistically significant increase: *p<.10 **p<.05 ***p<.01
DA/CA	=	Percentage points by which BMP awareness in *demonstration area* exceeds awareness in *comparison area*, 1994 (N = 20 BMP case comparisons; total 507 producers). Level of statistically significant difference: *p<.10 **p<.05 ***p<.01
blank cell	=	Non-significant difference at above levels.
not applic.	=	Absence of comparison areas (CA), or insufficient sample response size in comparison area (below 20) to permit analysis (FL).

Figure 9. Increases in Producer Awareness of BMPs within Demonstration Areas (DA), 1992–1994, and Differences in BMP Awareness Between Demonstration Areas and Comparison Areas (DA/CA), 1994

STATE Best Management Practice	FAMILIARITY 92–94 DA	 94 DA/CA	STATE Best Management Practice	FAMILIARITY 92–94 DA	 94 DA/CA
California (4 BMP cases)			Nebraska (4 BMP cases)		
Tailwater Recirculation	10**	na	Legume Crediting	10**	
Gravity Tailwater Recapture	20***	na	Soil Nutrient Testing		
Static Irrigation System	15**	na	Split Nutrient Application		
Float Valve System	20***	na	Irrigation Scheduling		
Florida (4 BMP cases)			North Carolina (2 BMP cases)		
Split Nutrient Application		na	Manure Crediting	15***	
Soil Moisture Testing	10**	na	Split Nutrient Application		
Irrigation Scheduling		na			
Irrigation System Testing		na			
Maryland (3 BMP cases)			Texas (3 BMP cases)		
Manure Crediting	10**		Soil Nutrient Testing	05*	
Legume Crediting			Split Nutrient Application		
Split Nutrient Application			Prescribed Burning		
Minnesota (4 BMP cases)			Wisconsin (4 BMP cases)		
Manure Crediting			Manure Crediting	05*	
Legume Crediting			Legume Crediting	05**	
Split Nutrient Application			Split Nutrient Application		
Irrigation Scheduling			Farmstead Assessment		

KEY:
DA = Percentage increase in *demonstration area* producers' familiarity with BMPs, 1992–1994
(N = 28 BMP cases; total 332 producers). Level of statistically significant increase: * $p <.10$ ** $p <.05$ *** $p <.01$
DA/CA = Percentage by which BMP average familiarity in *demonstration area* exceeds average familiarity in *comparison area*, 1994
(N = 20 BMP case comparisons; total 507 producers). Level of statistically significant difference: *$p <.10$ **$p <.05$ ***$p <.01$
blank cell = Non-significant difference at above levels.
not applic. = Absence of comparison areas (CA), or insufficient sample response size in comparison area (below 20) to permit analysis (FL).

Figure 10. Increases in Producer Familiarity with BMPs within Demonstration Areas (DA), 1992–1994, and Differences in BMP Familiarity Between Demonstration Areas and Comparison Areas (DA/CA), 1994

stration area. Unlike the "ceiling effect" partially limiting increased BMP awareness, there was considerable room for improvement in producer familiarity with the designated BMPs. The baseline survey found moderate familiarity with the BMPs, averaging slightly over three on a five-point scale.

Observed change in average degree of producer familiarity with the project-promoted BMPs was about the same in the comparison areas as in the demonstration areas for all 20 comparisons, by early 1994. In no instance did BMP familiarity in a demonstration area become significantly higher than in its respective comparison area.

Assessments of the BMPs

Hypothesis G: Demonstration area producers' assessment of project-promoted BMPs will become more positive.

Hypothesis H: Producers' assessment of the BMPs will become more positive in the demonstration areas than in the comparison areas.

Figure 8 showed the baseline distribution of producer assessments of the 28 BMP cases (13 different BMPs in the eight states). Assessments of some of the BMP attributes tended to be on the favorable side for a majority of the BMPs, but overall assessment was mixed. *In well over half the BMP cases, a majority of demonstration area producers lacked assurance* of the profitability and/or practicality of their using the project-recommended BMPs. Regarding some of those BMP cases viewed by a majority as "improving profitability" and/or "being practical" for usage, sizeable minorities of producers in some of the eight sites were unconvinced of BMP profitability and/or practicality.

- Demonstration area producers changed their assessments of the BMPs in only a few instances, with no significant increases in favorableness toward any of the BMPs.
- In no instances did demonstration area producers become significantly more favorable toward the BMPs than comparison area producers.

Demonstration area producers' evaluations of the specific BMPs—in terms of their practicality, profitability, expense, risk, difficulty, and impact on water quality in their communities—remained virtually unchanged over the two years. *In well over half the BMP cases, a majority of demonstration area producers continued to lack assurance of* the profitability and/or practicality of using the project-recommended BMPs. Regarding those BMP cases viewed by a majority as "improving profitability" and/or "being practical" for use, sizeable minorities of producers in some sites continued to lack assurance of some of these BMPs' profitability and/or practicality.

Usage of the BMPs

Hypothesis I: Demonstration area producers' use of project-promoted BMPs will increase.

Hypothesis J: Producers' use of the BMPs will increase more in the demonstration areas than in the comparison areas.

Figure 11 depicts that 26 cases of potential increase in BMP usage, (i.e., reported adoption) were evaluated across the eight demonstration project areas (12 different BMPs). Twenty case comparisons of demonstration area and comparison area gains in BMP usage were evaluated.

- Demonstration area producers' reported usage of the BMPs increased significantly in five (19 percent) of the 26 BMP cases (by the close of 1993).
- In one case reported BMP usage in a demonstration area became significantly higher than in its comparison area.

Across the eight sites, an average of about one-quarter of the producers reported use of the designated BMPs by the close of 1991. *Use increased for nearly one-fifth of the BMPs* by the end of the first two years of full operation of the projects (end of 1993). Increases in BMP use were fewer than increases in familiarity, consistent with

STATE **Best Management Practice**	**USE** 91–93 DA	 93 DA/CA	**STATE** **Best Management Practice**	**USE** 91–93 DA	 93 DA/CA
California (4 BMP cases)			Nebraska (4 BMP cases)		
Tailwater Recirculation	25***	na	Legume Crediting		
Gravity Tailwater Recapture	18**	na	Soil Nutrient Testing		
Static Irrigation System		na	Split Nutrient Application		
Float Valve System		na	Irrigation Scheduling		
Florida (4 BMP cases)			North Carolina (2 BMP cases)		
Split Nutrient Application	20**	na	Manure Crediting	15***	
Soil Moisture Testing	na	na	Split Nutrient Application		
Irrigation Scheduling	na	na			
Irrigation System Testing		na			
Maryland (3 BMP cases)			Texas (3 BMP cases)		
Manure Crediting			Soil Nutrient Testing		
Legume Crediting			Split Nutrient Application		
Split Nutrient Application	10*		Prescribed Burning		
Minnesota (4 BMP cases)			Wisconsin (4 BMP cases)		
Manure Crediting			Manure Crediting		
Legume Crediting			Legume Crediting		
Split Nutrient Application		15*	Split Nutrient Application		
Irrigation Scheduling			Farmstead Assessment		

KEY:
DA = Percentage increase in *demonstration area* producers' use of BMPs, 1991–1993 (N = 26 BMP cases; total 332 producers). Level of statistically significant increase: * $p < .10$ ** $p < .05$ *** $p < .01$
DA/CA = Percentage by which BMP usage in *demonstration area* exceeds usage in *comparison area*, 1993 (N = 20 BMP case comparisons; total 507 producers). Level of statistically significant difference: *$p < .10$ **$p < .05$ ***$p < .01$
blank cell = Non-significant difference at above levels.
not applic. = Absence of comparison areas (CA), or insufficient sample response size in comparison area (below 20) to permit analysis (FL).

Figure 11. Increases in Use of BMPs within Demonstration Areas, 1991–1993 (DA), and Differences in BMP Usage Between Demonstration Areas and Comparison Areas (DA/CA), 1993

expectations that producers build their familiarity with BMPs before increasing their use of them.

Change in average percentage point usage of the project-promoted BMPs was about the same in the matched comparison areas as in the demonstration areas, for 19 of the 20 case comparisons (95 percent), by the close of 1993. In the remaining case, 1993 BMP usage in a demonstration area was significantly higher than in its comparison area (split nutrient application in Minnesota). This significant difference occurred through an increase, (but not a statistically significant one), in demonstration area use of the BMP between 1991 and 1993.

Overall Findings of Area Analysis

The area analysis examines early 1992-early 1994 project effectiveness, *averaged across producers who had been (directly and/or indirectly) exposed to the demonstration projects and those who had not been exposed, i.e., had and had not received project I&E, technical assistance and/or financial assistance.* For the variables "perceived exposure to information on how farmers can protect water quality," "perception of water quality as a problem," and "assessment of BMPs," no significant increases were observed among the demonstration area producers, on average.

It was found that demonstration area producers on average: became *more aware of one-fifth* of the project-recommended BMPs and *more familiar with two-fifths* of these BMPs. Demonstration area producers *increased their use of one-fifth* of the BMPs.

In those BMP cases where statistically significant gains toward adoption were found among demonstration area producers, *BMP awareness, familiarity, and/or use increased by 5 to 25 percentage points*, with a median increase of 15 percentage points. Given that, on average, about 25 percent of producers were using the designated BMPs in 1991, it is estimated that *average use* across the project-promoted BMPs by the end of 1993 climbed by at least three percentage points.

No *net* gains, i.e.,—project impacts—relative to the comparison areas were observed by early 1994 in demonstration area producers' *awareness of, familiarity with, and assessments* of the BMPs. Only one net gain in demonstration area BMP usage, relative to its comparison area, was found by the close of 1993, among the 20 BMP case comparisons.

Overall, the increases observed suggest that producers, both in the demonstration areas and the comparison areas, gradually built their awareness of, familiarity with, and usage of the BMPs during 1992–93. Familiarity with the BMPs apparently grew faster than awareness of or use of them. There is lack of evidence that the demonstration projects *accelerated* producer awareness of, familiarity with, or use of the project-promoted BMPs between early 1992 and early 1994.

There is no evidence that producers in the demonstration areas or comparison areas became more favorable toward the designated BMPs between early 1992 and early 1994. Interpreted according to the model by Ervin and Ervin, the 1991–93 observed increase in *usage* of 21 percent of the BMPs appears due to (a) continuation in the amount of water quality information producers had been receiving; (b) continuation in producers' perceived degree of seriousness of water quality problems; and (c) continuation in producers' ratings of project-promoted BMPs.

Lack of an increase in favorableness toward the BMPs may have been the primary factor limiting 1992–93 adoption of the BMPs promoted by the demonstration projects.

Individual Producer Analysis

This analytical approach examines whether selected *characteristics of individual agricultural producers* are associated with their stage in the adoption process including use of the designated BMPs. Such statistical associations are intended to suggest the relative effectiveness of demonstration projects and other potential influences of adoption of project-recommended BMPs (1992–93).

Evaluation at the individual agricultural producer level is based upon a random "cross-section sample" of producers, i.e., all those who completed the questionnaire of the early 1994 final survey. (The previous analysis was based on a "longitudinal sample" of respondents who completed the questionnaires of *both* the early 1992 and early 1994 surveys). The analyses below are based on combined data from demonstration area and comparison area samples, i.e., sites.

Samples from five sites had sufficient numbers of responses and variable distributions for the following bivariate analyses that encompass: producers' awareness of demonstration projects, their exposure to information about specific BMPs, and specific BMP *awareness, familiarity, and usage* (Figures 12 and 13). Samples sizes of these states' sites are as follows: California (N=39 demonstration area respondents), Maryland (N=52 demonstration area respondents and 100 total respondents), Minnesota (N=58 demonstration area respondents and 100 total respondents), Nebraska (N=138 demonstration area respondents and 160 total respondents), and Wisconsin (N=63 demonstration area respondents and 180 total respondents). These sites had a total of 579 respondents.

For the following analysis of producer exposure to information about specific BMPs and their *assessments of these BMPs (Figure 14),* Texas was added to the previous five states (N= 50 demonstration area respondents and 97 total respondents). The six sites had a total of 676 respondents.

Hypothesis K: Awareness of demonstration projects will correlate positively with greater exposure to information about specific project-promoted BMPs.

By the time of the final survey in 1994, an average of nearly one-half the producers across the eight demonstration areas had become aware of the demonstration projects in their area. Among the five states in this analysis, the project with the highest awareness had 72 percent producer awareness, while the project with the lowest awareness had 40 percent producer awareness. A portion of those aware of the projects also had participated in project activities.

Individual producers' recent perceived *exposure* to information about specific project-recommended BMPs (during the 12 months previous to the final survey) was measured by an index, i.e.: (a) how much the producer had heard/read about the BMP was added to (b) how much she/he had paid attention to information received about the BMP. Both response categories are on a five-point scale, with a combined range of zero to ten points. The combined variable was divided at the mean into above/below average exposure.

Figure 12 depicts associations (chi-square values for two x two tables) between individual producers' awareness of the demonstration project in their geographic area, as an independent variable, and the following dependent variables regarding the designated BMPs promoted by their local project: (a) 1993 receipt of/attention paid to information about these BMPs, (b) awareness of these BMPs (c) familiarity with them, and (d) use of them. These relationships are *each* evaluated across 19 BMP cases (10 different BMPs), based on the 1994 final survey.

Across the five sites (i.e., demonstration areas/comparison areas) identified above:

- individual producers' awareness of their respective demonstration project is not correlated significantly with their 1993 perceived exposure (including paying attention) to information about BMPs promoted by the project;
- individual producers' awareness of their respective demonstration project is correlated significantly with their *awareness* of the project's BMPs in 32 percent of the cases;
- project awareness is correlated significantly with degree of *familiarity* with these BMPs in 58 percent of the cases; and
- project awareness is correlated significantly with *usage* of these BMPs in 15 percent of the BMP cases.

	EXPOSURE	AWARENESS	FAMILIARITY	USAGE
	(Chi-square value of relationship with *awareness of demonstration project*)[1]			
California				
Tailwater Recirculation				
Gravity Tailwater Recapture			5.6*	
Static Irrigation			4.1*	
Float Valve System			9.8**	
Maryland				
Manure Crediting		7.6**	7.0**	
Legume Crediting			3.4*	
Split Nutrient Application		4.0*		
Minnesota				
Manure Crediting		10.5**	5.7*	3.8*
Legume Crediting			6.9*	
Split Nutrient Application		12.0***		9.5**
Irrigation Scheduling		7.9**	4.7*	
Nebraska				
Legume Crediting		4.5*	5.9*	
Soil Testing			4.5*	
Split Nutrient Application				6.5*
Irrigation Scheduling			6.3*	
Wisconsin				
Manure Crediting				
Legume Crediting				
Split Nutrient Application				
Farmstead Assessment				

[1]Level of statistically significant chi-square value: *p<.05 **p<.01 ***p< .001
Blank cell indicates non-significant chi-square value at above levels.

Figure 12. Relationships Between Awareness of Demonstration Project and Specific BMP Information Exposure, BMP Awareness, Familiarity, and Usage (N = 19 BMP cases; total 579 producers)

Producers who, by early 1994, were aware of their area's demonstration project were no more likely to recall recently hearing, reading, or paying

attention to information about the project's BMPs than those unaware of the project.

The percentage of significant correlations for BMP familiarity may be higher than for BMP awareness as a consequence of the generally high level of awareness of the project-recommended BMPs.

Exposure to BMP Information and Adoption Processes

Hypothesis L: Greater recent exposure to information about specific, project-promoted BMPs will correlate positively with higher awareness of, familiarity with, and usage of these BMPs.

Figure 13 depicts bi-variate relationships between individual producers' perceived exposure, during 1993, to information about the specific, designated BMPs recommended by their local project (as an independent variable) and the following dependent variables concerning these BMPs: (a) awareness of these BMPs, (b) familiarity with them, and (c) usage of them. These relationships are *each* evaluated across 19 BMP cases (10 different BMPs), based on the 1994 Final Survey. Across the five demonstration projects identified above:

- individual producers' 1993 exposure to information about the BMPs promoted by their respective project is correlated significantly with their *awareness of these BMPs* in 53 percent of the cases;
- individual producers' 1993 exposure to information about their respective project's BMPs is correlated significantly with their *familiarity with these BMPs* in 95 percent of the cases; and
- individual producers' 1993 exposure to information about the BMPs is correlated significantly with their *usage of the BMPs* in 53 percent of the BMP cases.

The lower percentage of significant correlations for BMP awareness is likely a consequence of the generally high level of awareness of the project-promoted BMPs. In every instance of significant correlation between exposure to information about a specific BMP and *usage of that BMP*, there also is a significant association between exposure to that BMP and *familiarity* with the BMP (Figure 13). This linkage between significant correlation coefficients concerning familiarity and use would be expected according to the Ervin and Ervin model.

	AWARENESS	FAMILIARITY	USAGE
	(Coefficient of correlation with *exposure to information about specific BMP*)[1]		
California			
Tailwater Recirculation			
Gravity Tailwater Recapture		.53**	
Static Irrigation	.64***	.72***	
Float Valve System		.66**	
Maryland			
Manure Crediting	.41**	.75***	.34*
Legume Crediting	.37*	.75***	.37*
Split Nutrient Application	.38*	.70***	.36*
Minnesota			
Manure Crediting		.55**	.54**
Legume Crediting		.75***	
Split Nutrient Application		.71***	.41**
Irrigation Scheduling	.64***	.68***	
Nebraska			
Legume Crediting	.30**	.54***	.30**
Soil Testing		.46***	.32**
Split Nutrient Application		.31**	.24*
Irrigation Scheduling		.48***	
Wisconsin			
Manure Crediting	.41**	.55***	.51**
Legume Crediting	.42**	.71***	.37*
Split Nutrient Application	.42**	.63***	
Farmstead Assessment	.48**	.72***	

[1]Level of statistically significant correlation coefficient: *p<.05 **p<.01 ***p< .001
Blank cell indicates non-significant correlation coefficient at above levels.

Figure 13. Relationships Between Exposure to Specific BMP Information and BMP Awareness, Familiarity, and Usage, 1994 (N = 19 BMP cases; N = total 579 producers)

Hypothesis M: Greater recent exposure to information about specific, project-recommended BMPs will correlate with positive assessments of these BMPs.

The two project-promoted BMPs that were among the highest priority BMPs in each of six demonstration projects were used in the assessment analysis below (these BMPs are identified in Figure 14). That is, the association between individual producers' (a) 1993 perceived exposure to information about specific, project-

promoted BMPs and (b) their 1994 favorableness toward these BMPs is based on analysis of the two designated BMPs judged to have been promoted most by the six applicable projects (data from two sites having small sample response sizes were not used in this analysis).

Producers' *exposure* to information about these two BMPs was analyzed relative to their favorableness toward these BMPs relative to assessment variables (see Figure 8 for a complete listing). It is impracticable to provide all the correlations between producers' exposure to and assessments of the BMPs on all eight assessment variables (total of 96 correlation coefficients). *Illustrative BMP assessments* are examined across the six sites (demonstration area/comparison areas).

Illustrative correlation coefficients are provided regarding the associations between producers' 1993 exposure to information about the specific BMPs and their assessments of these BMPs' (a) ability to increase profitability, (b) practicality of use, (c) ease of use, (d) provision of water quality protection, and (e) ease of obtaining information on the BMP (Figure 14).

- *Increases profitability*: recent exposure to information about specific BMPs and belief that they increase profitability are correlated significantly in six (50 percent) of the 12 applicable BMP cases.
- *Practical to Use*: recent exposure to information about specific BMPs and belief that they are practical to use are correlated significantly in nine (75 percent) of the 12 applicable BMP cases. ("Practicality has a commanding strength of association with several other assessment variables, suggesting that to many respondents, the variable subsumes a number of other assessment items such as "simplicity/complexity" and "expense").
- *Ease of use*: recent exposure to information about specific BMPs and belief that they are easy to use are correlated significantly in one (8 percent) of the 12 applicable BMP cases.
- *Water quality protection*: recent exposure to information about specific BMPs and belief that they protect water quality are correlated significantly in six (50 percent) of the 12 applicable BMP cases.
- *Ease of obtaining information*: recent exposure to information about specific BMPs and belief that it is easy to get information about them is correlated significantly in eight (66 percent) of the 12 applicable BMP cases.

ASSESSMENTS

	Increases Profitability	Practical to Use	Ease of Usage	Protects Water Quality	Ease of Information
	(Coefficient of correlation with *exposure to information about specific BMP*) [1]				
California					
Gravity Tailwater Recapture					
Static Irrigation System					
Maryland					
Manure Crediting	.30**	.61**		.36***	.34**
Legume Crediting	.35***	.62**		.31**	.38***
Minnesota					
Manure Crediting	.32**	.50**			.35**
Legume Crediting	.35***	.53**			.48**
Nebraska					
Soil Nutrient Testing	.33**	.54	.25**	.22**	.35***
Irrigation Scheduling	.42**	.44		.39***	.36***
Texas					
Soil Nutrient Testing		.65		.62**	
Split Nutrient Application				.66**	
Wisconsin					
Manure Crediting		.47			.27***
Legume Crediting		.46			.33***

[1]Level of statistically significant correlation coefficient: *p<.10 **p<.05 ***p< .01
Blank cell indicates non-significant correlation coefficient at above levels.

Figure 14. Relationships Between 1993 Exposure to Information About Specific BMPs and 1994 Selected Assessments of these BMPs (N = 12 BMP cases; total 676 producers)

The above findings suggest that producers who received/attended to information about project-promoted BMPs were: *a little more likely than not to assess the BMPs as increasing profitability; likely to assess the BMPs as practical to use, and; not likely to assess the BMPs as easy to use.* Increased profitability and feasibility of BMP usage (practicality and ease of usage) are, of course, two variables vital to voluntary adoption.

Overall Findings of Individual Producer Bi-Variate Analysis

No significant correlations were found between producers' awareness of the demonstration project in their area and their 1993 exposure (receipt of/attention given) to information about the project's BMPs (Figure 12). This finding raises a question of whether producers who had been exposed to information about these BMPs had received such information through channels not directly linked to project staffs, e.g., through commercial farm magazines and/or other producers? BMP information generated by the demonstration projects could have been transferred to producers indirectly through non-project staff channels. For a proportion of BMP cases, there *is* a correlation between awareness of a project, on the one hand, and awareness of, familiarity with, and use of BMPs promoted by that project.

Comparing Figure 13 with Figure 14, it appears that producers having had greater 1993 exposure to information about a project's BMPs were more likely, by 1994, *to be familiar with these BMPs than to assess them favorably.* These findings regarding BMP assessment are based on an analysis providing considerable opportunity for observed association between information exposure and favorable assessment, since only the two designated BMPs judged to have received the most attention by each project were used in the analysis.

Overall, the above analysis indicates that individual producers who had been reached, during 1993 by information on specific project-promoted BMPs were also likely to have, by 1994, above average: awareness of about half of these BMPs; familiarity with almost all the BMPs; favorableness toward some of the BMPs (their attributes) but not others; and probability of usage of about half the BMPs.

The reverse also is probably true: i.e., those producers who already had higher levels of awareness of, familiarity with, favorableness toward, and use of given BMPs were more likely to receive and attend to information about them. *The findings do show encouraging linkages between overall 1993 transfer of information to producers about project-promoted BMPs and 1994 positive statuses on adoption variables regarding these BMPs.*

Multi-Variate Predictors of BMP Usage

This final analysis examines the relative strength of all measured characteristics of producers in accounting for their *use* of project-promoted BMPs by the close of 1993. The analysis addresses the question, "how well does each producer characteristic predict BMP use when all other characteristics are simultaneously considered?" In order to address this question, it was necessary to limit the analysis to three demonstration areas and comparison areas having samples with a sufficiently large number of responses, as well as sufficiently high rates of producer use of the same BMPs across sites.

This analysis is confined to sites where the same BMPs had been promoted and where number of sample responses (demonstration areas and matched comparison areas) was robust. This included—Maryland (N=115 respondents), Minnesota (N=102 respondents), and Wisconsin (N=190 respondents)—for a total of 407 respondents.

Projects in each of these states each had manure crediting and legume crediting as highly recommended BMPs, with use rates across these states ranging from 54 percent in 1992 to 62 percent in 1994 for manure crediting, and 47 percent in 1992 and 62 percent in 1994 for legume crediting. Data from the 1994 survey for these three states' demonstration areas and matched comparison areas were merged; then the producer characteristics predicting use of the two BMPs were identified and compared in strength of predictive power.

The Ervin and Ervin model (Figure 3) provides the analytical structure to statistically account for patterns of BMP use within the limited grouping of BMPs and demonstration/matched comparison areas. Predictors are defined as those which have partial correlations with 1993 *usages* of the two BMPs at less than the 0.10 level of probability/statistical significance (Figure 15). Partial correlations indicate the strength and direction of association between each potential predictor and BMP use, holding constant the effects of all other potential predictors. Differences between the three sites are removed statistically from the analytical findings.

The leading predictors of individual producers' use of manure crediting were their *gross income* and their *attention to information about the BMPs*; the higher income and the more attentive producers were most likely to be users. Producers who assessed manure crediting as more *practical* were also most inclined to use it (Figure 15a). As mentioned above, producer assessment of the "practicality" of a BMP appears to be a rather holistic assessment of the feasibility of using it.

For legume crediting, the leading predictors of use were producers' *gross income,* and their evaluation of the *simplicity/complexity of the practice*: higher income producers, and those viewing the practice as less complex were more likely to be users (Figure 15b).

Producers' annual gross income and *BMP assessments* (especially perceived

Factors Affecting Use of Manure Crediting
(N = 407 producers in three sites)

Ervin & Ervin Model Component	Component Variable	Partial Correlation	Statistical Significance
Economic Factors	Gross Income	.22	.01
Information Exposure	BMP Attention	.20	.01
Problem Perception	Farm Impact	-.07	.09
Practice Awareness	Familiarity	.07	.08
Practice Assessment	Simplicity	.07	.07
	Practicality	.18	.01

Factors Affecting Use of Legume Crediting
(N = 407 producers in three sites)

Ervin & Ervin Model Component	Component Variable	Partial Correlation	Statistical Significance
Economic Factors	Gross Income	.11	.03
Information Exposure	BMP Attention	.07	.06
Problem Perception	Problem Importance	-.09	.04
Practice Assessment	Expense	.06	.08
	Simplicity	.25	.01
	Information Ease	.08	.08

Figure 15. Predictors (Partial Correlation Coefficients) of Use of Manure Crediting and Legume Crediting, 1993/1994

"practicality" and "simplicity") are found to be leading, significant predictors of 1993 usages of legume and manure crediting. *Attention to specific information received about these BMPs* was also a significant predictor of usage in both the above analyses.

It is noteworthy that neither a *producer's farm location in a demonstration area*, nor *awareness of the demonstration project in his area,* were significant predictors of usage of these two BMPs.

An overall inference based on the above findings follows: information about the BMPs was sufficiently similar and pervasive across the demonstration areas and comparison areas to mask any demonstration project impacts on BMP adoption during 1992–93. An early subsection in this report, "Exposure to Information about Protection of Water Quality" documents the strength, pervasiveness, and variety of sources of information about agricultural practices that protect/improve water quality. *Producers' differential receptivity to information generally available about these BMPs appears to have been more important in determining their 1993 usages than the additional BMP information made available through the projects.*

Contrary to the primary model for this evaluation (Ervin and Ervin 1982), those producers who saw water quality as *a less serious problem* were more likely to be users of these two BMPs. Producers' economic status, interest in the two BMPs, and their assessments of them emerged as common predictors of usage.

Qualitative Evaluation of Project Efforts

Qualitative evaluation of the demonstration project efforts focused on four aspects of the *"Institutional Factors"* and *"Demonstration Project/Communication Campaign"* components of the Ervin and Ervin model of adoption processes. These four aspects are: (1) project planning and evaluation; (2) field demonstration methods, including some site-specific applied research; (3) information transfer and education methods; and (4) organization of the project including budgetary factors. *The role of cost sharing and technical assistance in the adoption process has been neglected here.* These were not examined due to the low level of adoption observed during 1992–1994. However, inferences may be drawn regarding the potential influences of cost sharing and technical assistance from producers' assessments of the BMPs.

Project efforts are assessed in the context of the goals, strategies, and tactics that these projects *collectively* employed. Projects varied in number of staff, focus, and resources available. Also, the mix of field demonstration and information transfer and education (I&E) methods across the eight projects varied considerably. These variations were due partly to "external factors," i.e.: differences in the types of BMPs being promoted; the nature of the public being targeted; and the availability and utility of communication channels including the mass media.

Variations in field demonstration and I&E methods also appear partly due to certain "internal factors" including: availability of professional information staff to the project; willingness to provide project support for such expertise; and the importance given to I&E relative to other project attributes. The above cited variations make evaluative comparisons among individual project efforts difficult, if not impossible.

Project Planning and Evaluation

Project planning may be enhanced by formative evaluation of producer characteristics and needs. Continuous evaluation over the project's duration can help meet project objectives, as well as provide a basis for project improvement.

Formative Evaluation

Formative evaluation is based on data collected prior to or early in the project. It addresses producers' use of BMPs selected for project promotion, their levels of relevant BMP knowledge and information needs, and preferred communication delivery channels. Such data can assist project planners in segmenting area producers and targeting them to receive appropriate best management practice (BMP) information.

Projects used varied sources of data to identify producer agronomic concerns and to help determine which BMPs to prioritize. But several projects lacked data on producer socioeconomic characteristics and attitudes associated with agricultural practice use. Where such data were available, projects were better able to specifically identify and address producer segments according to their prior awareness of, familiarity with, assessments of, and uses of project-selected BMPs as well as their information channel preferences. As staff members of the California and Florida projects put it (paraphrased from Nowak, O'Keefe, et al. 1996, Vol. 2: 96 and 111- 117):

> We initially knew very little about perceptions of the producers regarding barriers to adopting the BMPs. Our 1991 survey helped us understand the reasons producers would or would not change systems. In 1991, we also conducted two focus groups with producers. Information from these sessions helped us to understand producer concerns and to write a marketing plan.

Some projects apparently segmented their producer audience intuitively, while others segmented them explicitly. Other projects treated producers as a homogeneous group. A specific explication of audience segments can further assist projects in their I&E planning, targeting and implementation. Having professional communication and program evaluation expertise devoted to this effort can strengthen project effectiveness. An example of audience segmentation used by the Minnesota project follows (Nowak, O'Keefe, et al. 1996, Vol. 2:158):

> Cooperating farmers were categorized based on staff perceptions of their ability/willingness to employ BMPs and continue their use following completion of the demonstration project. These categories varied from "very progressive—receptive to BMP adoption and will sustain practice use" to "limited ability and incentive to adopt BMPs." The categories were used to aid in prioritizing I&E efforts to individual producers.

According to interviews with project personnel, farmer concerns run the gamut from making a living to complying with regulations. Regarding economic concerns, most producers have continuously experi-

enced squeezed profit margins; and some smaller farmers fear they may lose everything in one year if they make agricultural practice changes. Producers are often concerned about EPA chemical restrictions, and can be generally characterized as anti-regulation.

Factors such as productivity and economic viability often precede water quality in producers' priorities. This is not to say that producers are generally unconcerned about water quality or their impact upon it, but instead that a host of day-to-day issues continuously have greater immediate salience. These priorities provide opportunities for the project I&E efforts designed to link BMP economic advantages with their environmental utility. Some projects have conducted *surveys and focus groups* to better understand producers' perceptions of the project, water quality problems, and BMPs. Information gleaned has helped identify producer priorities and appropriate approaches to information dissemination.

Feedback Mechanisms

Project personnel across the board have *informally* sought producers' verbal opinions and perceptions about BMPs and project activities. This has been most successful in one-on-one situations, usually at the producers' own operations, where they may be more likely to discuss their opinions. Interviewed project staff disagreed on whether participating producers are willing to openly express their dislike of a given BMP. Staff agreed that producers who are demonstrating the use of project-recommended BMPs on their farms criticize any BMPs that result in reduced crop yields.

At least four of the projects have obtained feedback by *formally* eliciting producers' evaluations of project activities such as tours, field days, meetings, and related events. However, project staff have found that the proportion of participants in such activities willing to fill out reaction forms varied from less than half in one of the projects, to nil in another project. One project conducted telephone surveys of producers' perceptions of project-disseminated information; another asked selected producers to review a major publication before final printing and dissemination.

Extent of farmer participation in advisory committees has varied. Type and extent of such input seems related to many factors, including (a) the local and bureaucratic milieu (influencing the willingness and selection of farmers to participate) and (b) the number and variety of opportunities for producers' input. Some projects include producers on an executive council and/or local councils.

Project Field Demonstration Methods

In project field demonstrations in collaboration with producers on their farms, project staff typically have helped select field demonstration methods, implement, test, demonstrate, and evaluate the effectiveness of one or more BMPs on a limited scale. Most projects spatially distributed the sites for field demonstrations, whatever their type. Some projects have rotated field demonstration sites among different host producers over time.

Characteristics of the Field Demonstrations

Characteristics of demonstrations have varied across states. For example, California initially employed farm demonstrations at two sites, and later established a greater number of satellite demonstrations to test BMPs in diverse settings. The Maryland, Minnesota, Nebraska (University of Nebraska and Natural Resource Conservation Service 1997), and Texas projects each have involved between 30 and 60 cooperators to demonstrate BMPs on their respective fields. Maryland established one-acre plots on at least 60 farmers' respective properties. These variations between demonstration projects are affected by type of agriculture, size of farms, and geographic considerations.

Public access to and size of demonstration fields vary widely. Most projects posted signs at demonstration sites, listing the names of the cooperator, the project and/or the cooperating agencies. However, because of confidentiality (i.e., regulatory and competitive) concerns, one demonstration project simply collected data at designated sites, and presented the findings at meetings without specifying the site/owner.

It takes time to prove a BMP in a locality, with additional time needed to cope with extremes in weather. As staff members of the Minnesota and Wisconsin projects explained (paraphrased from Nowak, O'Keefe, et al. 1996, Vol. 2: 155, 186 and 279).

> A cooperator may allow the project to apply a BMP to a one-acre strip in a 40- acre field. Phase I of evaluating the BMP may be to see how this works across one to three years; then the producer may decide whether to expand the BMP over more acreage. Moreover, weather conditions can cloud the evaluation of BMP effectiveness. During some years, no matter what a producer does, it works. In other years drought, heat, cold, etc., can prevent BMPs from selling themselves. For this reason, it is often necessary to extend the field demonstrations over several years.

USDA's Water Quality Program Plan (1989) appears to have emphasized the use of *result demonstrations* to promote the adoption of project-recommended BMPs. Such demonstrations are aimed at promoting the adoption of practices already proven to be effective in the specific situations. As stated in the USDA Water Quality Plan, the demonstration pro-

jects would "utilize the best available research data ... to design and demonstrate ... systems that minimize surface water and groundwater loadings of agricultural chemicals and wastes" (1989, 21). But, result demonstrations differ from *test demonstrations,* which may include applied research activities to determine the site-specific cost-effectiveness of locally adapted variations in practices (Bennett 1984; Glenman, Hederman, Johnson, and Retig 1978; Hancock 1992).

Adaptive Research Issues

At the beginning of their respective demonstration projects, local staffs selected several practices to test/promote within their project area. The selection was based on local agronomic and hydrologic conditions, coupled with what were perceived to be the best remedial practices. These practices were then labeled BMPs, to be consistent with national program objectives and guidelines. *The "BMP label" provided a unifying terminology across the projects. However, there were varying degrees of local evidence that these practices would actually meet the goals of achieving optimal economic, environmental and agronomic impact within the demonstration project areas.* Some staff had difficulty in resolving the differences between national and state terms and definitions for practices, and the need to evaluate the performance of these practices, or adaptations of these practices in local settings.

The projects found need to allocate significant amounts of project resources to conducting field demonstrations in order to test/increase local economic, environmental and agronomic benefits of the promoted practices (compared with the conventional practices used by most producers). Some projects delayed initially planned result demonstration and dissemination efforts until test demonstration data could be obtained locally.

In USDA's Water Quality Program Plan (1989, 21) and project budget approval process, emphasis appears to have been placed on disseminating and demonstrating the results of research-proven practices, i.e., "utilize the best available research data." This likely differs from using on-farm research to evaluate local adaptations of available research. The question becomes one of the local applicability of practices proven effective elsewhere. The USDA Water Quality Demonstration Program appeared not to allocate resources, including time periods necessary, for generating and testing the environmental as well as economic benefits of local adaptations of the best available research data on BMPs.

Bases for promoting BMPs varied by the degree to which staffs emphasized economic or environmental benefits. Project staff viewed some practices as having minimal economic advantages in light of risks associated with potential yield losses. Some staff members saw, for example, manure and legume crediting as problematic in this way (although, as noted above, the 1992 baseline survey did not find that most producers share this concern).

Furthermore, as noted above, numerous staff members commented that their projects initially lacked substantive local data to support claims that certain BMPs are environmentally effective and economically advantageous as compared to in-place practices. Some staff indicated that lack of *local* data (collected in the project area on producer farms) made it difficult to reduce producers' perceived risk of changing practices. This difficulty especially arose early in the life of the projects, during the 1992–94 period of this evaluation.

Staff members from the Florida projects explained as follows the necessity of having site-specific data for project information and education (Nowak, O'Keefe, et al. 1996, Vol. 2: 111–115):

> When the project started, the perception was that we were going to take those BMPs that we had and demonstrate them. But, we didn't have enough data to show farmers that they were a cause of the excess nutrients in surface water in the locality. We had to spend the first two years collecting data to prove what was going on physically—in the system of BMPs—in order to have a story to tell. If producers are encouraged to apply fertilizer in multiple applications, they may save $20 per acre on fertilizer. But in doing so, they may also incur increased labor costs. The increased labor costs may not be so great as to discourage adoption, but agents need to have good arguments to sell producers on the concept.

By definition, BMPs are supposed to be economically viable, as well as environmentally advantageous. In actuality, project staff questioned whether some BMPs were economically viable compared to in-place local practices. The environmental benefits of some practices may have been open to question in some projects. All this served to inhibit the promotion of some BMPs on economic and environmental grounds, at least during the earlier years of the projects covered by this evaluation.

Based on the situations described above, most of the projects necessarily used their on-farm demonstration efforts as applied research—to collect locally relevant data to inform educational efforts. Not surprisingly, lack of sufficient funds to support needed site-specific research was frustrating to some staff, as are the fuzzy lines sometimes drawn between adaptive research efforts and demonstration efforts. As a California Extension agent and a Minnesota NRCS agent put it succinctly (Nowak, O'Keefe, et al. 1996, Vol. 2: 109 and paraphrased from 186).

> "If you're demonstrating techniques, you have to have some statistically viable research. But,

the project will not fund research. This is all relevant to communicating with producers: you need good information/data to be able to communicate with strength."

There is little regionally available research that represents what producers actually do in the project area. A lot of research has been done in places and by means that producers don't use themselves.

In short, project performance in information transfer/education is short-changed without locally-based, recent/current substantive data to back up claims of BMP cost-effectiveness in achieving producers' goals. Producers are justifiably skeptical when their profit margins are on the line, and their changes in evaluation and adoption of BMPs may be put off until site-specific data are accumulated, verified and repeatedly presented over time. Weather fluctuations, such as those experienced in the Midwest during 1992 and 1993, may prolong the process of completing the local test demonstrations/applied research necessary to help producers assess project-promoted BMPs more favorably.

Project Information Transfer and Education Methods

Information transfer and education (I&E) efforts should capitalize on as many communication vehicles as possible: overlapping and complementary messages are more likely to leave a lasting impression on their audiences. The underlying theory is that broadly and frequently disseminated mass mediated messages have the potential effect of positively reinforcing interpersonal communication efforts toward increased adoption (Figure 16). Projects varied in their ability to disseminate information through multiple channels.

It would be unfair here to compare one project against another in terms of communication emphases or media mixes, if for no other reason that, as the detailed Technical Report of the evaluation indicates, each of the projects faced different objectives, audiences, tools, staff and resource combinations (Nowak, O'Keefe, et al. 1996, Vols. 1 and 2).

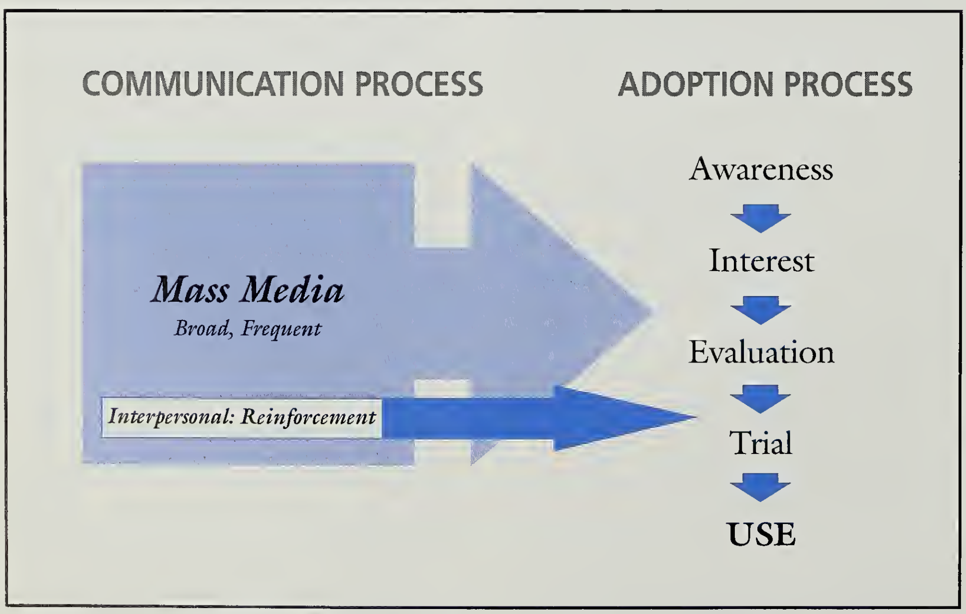

Figure 16. Communication Related to the Adoption Process

Group Contacts

Typically, several field days and tours have been conducted annually at the field demonstration sites, each targeting specific audiences—i.e., not only producers, but also different types of agricultural leaders and industry and community representatives. "Neighborhood field days can be a good way to display demonstration activities and findings because neighbors often attend as a courtesy to the host," explained a staff member of one of the projects.

Most projects identified and connected with local groups and organizations that potentially influence and are affected by producer decisions to adopt the project-recommended BMPs. Farm input dealers, cooperatives, and consultants have attended project tours/events, and have discussed BMPs or attended planning meetings along with producers who cooperate in conducting on-farm demonstrations. Most of the project staffs also met with local community organizations (e.g., Kiwanis, county commissioners), elementary schools, environmental organizations, and local district personnel of other public agencies.

Project Demonstrators

Producers with strong public images were sought as project demonstrators. Producer cooperators who work with the demonstration projects to field-test BMPs often "believe in the project." Such demonstrators can be excellent spokespersons for the BMPs, both interpersonally and at public events (paraphrased from Nowak, O'Keefe, et al. 1996, Vol. 2: 113).

> "When a cooperator says anything about a BMP's use, it makes a big difference. This is especially important where some producers are nervous about the BMPs being promoted 'by the government,' fearing that they would lose yields by adopting them."

Personal Contacts

Across all projects, project staff and producers have preferred one-on-one contacts, communication, and education with the wider audience of producers. Therefore, staff prioritized one-to-one instruction as their predominant method of information transfer and education. Staff across all projects affirmed that interpersonal, one-on-one information transfer was the most important and emphasized communication method upon which projects rely to obtain producer adoption of project-recommended practices.

BMPs frequently must be tailored to meet the requirements of individual producers—i.e., "generic" practices must be modified to fit into the producer's operation without undue cost or risk. Also, personal communication responds to producers' individual time availability and timing of need to learn about the practices. These are the main reason that one-to-one communication between producers and project staff members is considered by project staff to be the most effective way to promote the consideration and adoption of recommended BMPs.

Project staff tend to feel so intensely about the effectiveness of personal contact that they sometimes feel *conflict* between the importance of laying out and tending to demonstration plots, on the one hand, and on the other teaching individual farmers when they are ready to receive instruction at the site of their farming operations. As articulated by a Wisconsin staff interviewee (paraphrased from Nowak, O'Keefe, et al. 1996, Vol. 2: 279 and 303):

> Demonstration plots can require a lot of time. Sometimes, our efforts are better spent working with farmers, one-on-one, than in laying out a demo plot. You need to be available to farmers when they call the office for help; you need to make it as convenient as possible for them to get you and your information. Working on demo plots may actually make project personnel inaccessible to inquiring producers.

Mass Media

Mass media (e.g., local and regional newspapers, television, and radio) have been used extensively in all projects to build producer awareness of the projects, their objectives, and their activities, and in turn promote awareness of and familiarity with the characteristics of the project-recommended BMPs. For example, local newspapers and radio stations have covered project field days in response to project invitations.

Projects' uses of media were contingent on external factors including (1) the receptivity of press outlets to agricultural stories (the more urban the area, the less receptive or interested is the press, television, and radio) and (2) turnover at newspapers (primarily rural) that inhibited development of long-term relationships. It is difficult to evaluate the projects' greater or lesser use of mass media without consideration of these contextual factors:

Projects' uses of media were also contingent on internal factors such as (1) staff time available to produce stories/press releases and make media contacts in person or over the telephone, and (2) the priority placed on media dissemination by the project and aggressiveness of staff in pursuing these avenues.

Some staff members believe that mass media are negligibly effective, because outlets may be more interested in controversy than in useful dissemination of information. All projects attempted to publicize project events through mass media outlets, and to feature BMPs/producers in stories on occasion—at a bare minimum. Some projects successfully produced public service advertisements for radio and television, in addition to conducting interviews and engaging in other media efforts.

Controlled Media

Every project has made an effort to disseminate information about BMPs, and producer experience with BMPs, via either mass-mailed project or agency newsletters. Project newsletters, brochures, fliers and fact sheets have been mass mailed on a limited basis (e.g., several times a year) because of postage costs. Exceptions to this rule are specially produced bulletins or fliers that attempt to present new (or freshly packaged) information.

Most projects developed their own mailing lists by various means—including accessing multiple agency lists, tax records, plat books, and door-to-door canvassing. Project mailing lists varied greatly in size, from (approximately) 200 to 24,000, with different mailing lists used for different types of mailings. This effort was variously labor-intensive and time-consuming, depending on the projects' strategy and list size.

Every project disseminated information about BMPs/producer efforts via either mass-mailed special materials (e.g., fact sheets) or newsletters.

Fairs and Other Public Events

The projects have had displays at agricultural exposition shows, farm progress days, country fairs, agricultural commodity conferences, statewide field days devoted to water quality, field days at district research facilities, etc. The displays described not only the demonstration projects but also provided technical information on such topics as nutrient management, water well and septic systems, IPM, and soil testing.

Dealers, Consultants, and Lenders

Dealers and private consultants have cooperated with some of the projects, and generally have been drawn closer to project staffs through the project activities. Projects varied in their extent of *deliberate* partnership building with such private-sector specialists.

The Nebraska project organized a local committee in each of the counties of its demonstration project area. These committees decided upon and prioritized project activities in the county. The committees included consultants, bankers, and dealers including representatives of cooperatives. This project has endeavored to train farmers to ask consultants appropriate questions about their recommendations, in order to help farmers better use the information, knowledge, and advice offered by consultants.

The Wisconsin project took an unusual step of involving agricultural lenders in their I&E strategy, especially with an aim of lenders encouraging producers to work through the Farm*A*Syst materials so as to assess contamination risks on their respective farmsteads. Lenders are concerned about reducing liability threats on properties in which they have invested.

Project Communication Specialists

Mass media, direct mail, networking, and local meetings constituted important information transfer and education components of the demonstration projects. Some projects were more adequately staffed than others with personnel specializing in information and education; for example the Nebraska and Wisconsin projects made expert communication assistance available. Most local project personnel claimed that their projects did benefit, or would have benefitted, from sustained assistance of communication professionals. Communication specialists were expected to have experience both in media and group processes, as well as reasonable technical background regarding the BMPs relevant to the local project.

While most projects have had occasional editorial or publication assistance from state-level personnel, sustained on-site positions dedicated to formulating and implementing strategies for mass communication or publicity were rare. Local project personnel—Extension and some NRCS employees—attempted to integrate article/press release writing and publicity efforts into their schedules, but were often challenged to balance all demands on them. Staff interviewed frequently commented that they were concerned that hiring a professional communications person would mean a loss of a staff person dedicated to one-on-one interaction with producers or on-farm demonstration efforts—both essential to project efforts to accelerate adoption. It appears that funding a communication position tends to be a struggle, especially where funding is tight and the position's purpose is not adequately defined or prioritized.

Most of the I&E campaigns supporting the demonstration projects were found to lack long-term (e.g., five-year) coordinated plans that integrated the project use of public media with their use of controlled media and other I&E approaches.

Project Organization, Staffing, and Funding

Some demonstration projects established separate project offices and interagency logos, while staff of other projects operated out of their respective Agency offices. CES, NRCS, and FSA project staff were in some cases located in the same building complex, providing less rationale for the establishment of a separate project office. Maryland, Minnesota, Nebraska, Texas, and Wisconsin established separate demonstration project offices apart from the county CES, FSA, and NRCS offices.

Consultation with Stakeholders

Several of the projects have implemented project coordinating committees, comprising representatives of the collaborating USDA and State Cooperator Agencies; community and regional officials; agri-chemical dealers, consultants, and bankers; and Soil and Water Conservation District and local and state conservancy boards. Nebraska's project exemplifies strong input from a formal, overall advisory committee.

Project Staffing

Some project staff have felt that Agency administrators for their respective projects were not sufficiently committed to the projects to assign sufficient staff with enough time, technology, and authority to effectively conduct the projects.

Lack of consistency in communication specialist staffing has been a problem for some projects: staff turnover especially led to limitations in project expertise for project mass communications/public relations. Project staff generally consider it necessary for project communicators to be able to handle the technical aspects of BMPs.

Duration of the demonstration projects has turned out to be four years longer than the *five years of funding* that was initially planned by USDA. Because of an expected project length of five years, significant proportions of project technical and communication staffs voluntarily took alternative employment during the fourth year of the projects. Inability of state Cooperative Extension Services to provide a clear, early definition of actual project duration has had a significant impact on their hiring and retention of employees for the projects, as well as the magnitude of resources needed to recruit and train replacement employees while rebuilding project teams.

Funding Issues

Complex Federal-State relationships among the collaborating USDA and State Cooperator Agencies made most projects more difficult to efficiently carry out. CSREES/USDA funding uncertainties, lags, and late notification of project extensions to a varying extent affected all projects, resulting in decreased momentum as well as personnel losses on the Extension side. Fluctuations in adequacy of staffing also occurred in NRCS, for other reasons (Nowak, O'Keefe, et al. 1996, Vol. 2: 222).

While project staffs supported by NRCS/USDA funds regularly received their Agency's funding early in the Federal fiscal year, project staff supported by Cooperative Extension generally received their project funds late in the Federal fiscal year. For parallel and jointly conducted project activities, both Cooperative Extension and NRCS staffs needed project funds to cover their respective resource requirements. This meant that Cooperative Extension staff often had to negotiate with their respective state-level accounting offices for advances, in order to keep their activities moving forward until project funds arrived from Washington, D.C. —i.e., late relative to annual funds received by NRCS. Some planned interagency project activities were shelved due to funding uncertainties. Because of such uncertainties, project staffs from the partner agencies often adopted annual, separate, planning frames rather than long-range, interagency, coordinated efforts.

Summary and Discussion

This evaluation is in response to USDA's charge to evaluate the performance and effects of the first eight demonstration projects, by the close of 1994. Six factors may constrain the degree to which project outcomes and impacts can be fully documented by this evaluation. These factors were discussed earlier and are summarized here for convenience.

- The final survey was conducted early in the life of the projects.
- The priority of about half the BMP cases was lessened from that of their originally high priority set during project planning in 1991.
- There was some failure in the operation of at least two of the comparison areas.
- The observed 1992–93 increases in BMP awareness and familiarity may have been inflated due to "learning effects" of producer exposure to the baseline survey.
- There were small numbers of respondents in two sites, i.e., the actual sample sizes of the individual demonstration areas and their matched comparison areas were between 19 and 30 respondents. However, the statistical pattern of findings from these two sites did not vary noticeably from the pattern of findings from the other sites, including two sites where the actual sample sizes of the demonstration areas and the comparison areas each varied between 44 and 50 respondents.
- There is lack of findings on acreages of producer adoption and accuracy of producer adoption.

Demonstration Areas, 1992–1994

The area analysis examines the extent to which demonstration area producers—averaging across those who had participated directly in the project and those who did not—made gains in the adoption processes, from early 1992 to early 1994. By stage of the adoption process, demonstration area producers, as a whole:

- became more aware—with statistical significance—of six (21 percent) of the 28 BMP cases;
- became more familiar—significantly so—with eleven (40 percent) of the 28 BMP cases;
- did not significantly change their assessments of—i.e., did not become more favorable toward—any of the 28 BMP cases; and
- reported increased usage—with statistical significance—of five (19 percent) of the 26 BMP cases examined (by the close of 1993).

Producers increased their awareness of the BMPs being promoted to a modest extent, in terms of average percentage being at all aware of the specific BMPs. Producers made considerable gains in familiarity with the BMPs, in terms of average degree of familiarity on a five-point scale. Producer awareness of most of the BMPs was already high at the onset of the demonstrations; thus the bigger gains in familiarity than in awareness are expected.

Producers also adopted the BMPs to a modest extent, in terms of the percentage who reported use of the BMPs in 1991 and in 1993. In cases where statistically significant gains were found, producers' BMP awareness, familiarity, and/or use increased by five percent to 25 percentage points, with the median increase of 15 percentage points.

BMP awareness, familiarity, and use were more likely among those producers who reported that they had, during 1993, heard or read information about the specific, project-promoted BMPs and had paid attention to such information. These findings suggest that when project information was conveyed to and reached individual producers who were interested, such information contributed toward adoption of project-promoted BMPs.

Producers in the demonstration areas became more positive toward some of the BMPs, in terms of percent of their ratings indicating extent of advantage of using these BMPs. But, the degree of change was not sufficient for statistical significance. The lack of change in producer assessments of the BMPs by early 1994 may be due partly to the fact that producers' initial attitudes toward some of the BMPs were already fairly positive, allowing less room for positive changes.

A more likely explanation for lack of a significant increase in producer favorableness toward the BMPs is that most projects had not yet been able to develop substantial local test-demonstration data to *verify, both for some project staff and producers,* the economic and environmental benefits of, and the feasibility of using, the project-recommended practices. Interviews with project staff indicated that they viewed such data as essential to increasing the degree to which producers positively assess BMPs to the point where they are willing to try using them to a significant degree.

Producers in the demonstration areas did not change their attitudes regarding *local* agricultural practices' influence on *local* water quality

problems. Water quality problems and their causes remained to producers as more generalized abstractions, and perceived as unrelated to BMP adoption.

The limited number of BMP adoptions found during the time period of this evaluation did not allow for examination of the influences of cost sharing and technical assistance on adoption variables.

Demonstration Areas and Comparison Areas, 1992–1994

The area analysis also compared the extent to which producers in the demonstration areas and in the matched geographic areas made gains on the adoption variables.

- Relative to increases in the comparison areas, only scattered *net* increases occurred in demonstration area producers' awareness, familiarity, and use of the BMPs.
- Only one significantly higher value on an adoption variable was found for the demonstration areas relative to their respective comparison areas in the 20 BMP case comparisons.

These findings prevent a conclusion that the demonstration projects directly influenced BMP adoption processes at the area level, by 1994. Similar amounts of gain in BMP awareness, familiarity, and usage were found in the comparison areas, as well. The similar gains in the comparison areas may have been due primarily to the *vast, strong overall agricultural information and communication systems in the eight sites.*

As reflected by findings of the baseline survey, these communication systems include: information transfer from producers already using the project-promoted BMPs to other producers (there is much producer-to-producer contact regarding the local performance of, and how to implement, practices that individual producers are considering for trial/adoption); and extensive, in-depth commercial farm magazine and farm news coverage of BMPs and/or water quality issues.

Some of the gains observed in some of the comparison areas may have been due to projects resembling the demonstration projects—i.e., projects that were conducted within the comparison areas by agricultural/natural resource state agencies.

A small part of the comparison area gains may have come from observed and potential "overflows" from demonstration project publicity and staff assistance to the comparison locales; and a small part of such gains also may have come from information sharing by demonstration area producers to comparison area producers.

Individual Producer Findings

The individual producer analysis examines whether producers' characteristics, across demonstration areas and comparison areas, are associated with their 1994 status regarding adoption of the project-recommended BMPs. Four bi-variate analyses were conducted as well as a multivariate analysis.

Respondents first were divided into (a) producers who had, during 1993, received and paid attention to information about specific BMPs promoted by their respective demonstration project, and (b) those who had not. Producers who had *received and paid attention to information* about the BMPs were significantly more: *aware* of the BMPs in 53 percent of the cases; *familiar* with the BMPs in 95 percent of the cases; and likely to be *users* of the BMPs in 53 percent of the cases. These findings are based on an analysis of 19 applicable BMP cases in five sites having requisite sizes of sample response.

Receipt of/attention paid to information about project-recommended BMPs also was found to link with more favorable *assessments* of these BMPs. Analysis of two top-priority BMP cases in each of six sites showed that: individual producers' 1993 receipt of/attention paid to information about specific, project-promoted BMPs is significantly associated with their 1994 ratings of these BMP's profitability in six (50 percent) of the 12 BMP cases; practicality of use in nine (75 percent) of the 12 BMP cases; and ease of BMP use in one (eight percent) of the 12 BMP cases.

This latter finding is consistent with technical expert ratings that most of the BMPs designated for this evaluation have high management and/or labor requirements.

The above findings show encouraging linkages between individual producers' recent receipt of/attention to information about project-recommended BMPs and their awareness of, familiarity with, favorableness toward, and use of these BMPs. However, these findings do not identify the *channels* from which producers received information about these BMPs.

A possibility is that an important channel of information about project-promoted BMPs was the demonstration project activities. This possibility is supported by the following findings: producers' *awareness of the demonstration project in their area is associated with awareness* of the project's BMPs in 32 percent of the 19 applicable cases; *familiarity* with these BMPs in 58 percent of these cases; and *usage* of the BMPs in 15 percent of the cases.

It is questionable whether information received *directly* from the demonstration projects had important influenced on BMP adoption processes by close of 1993/early 1994. Producers who were *aware* of their area's demonstration project *were not* more likely to have received/paid attention to 1993 information about specific BMPs promoted by the project.

That is, *producers who, by early 1994, were aware of their area's demonstration project were no more*

likely to recall recently hearing, reading, or paying attention to information about the project's BMPs than those producers unaware of the project. A positive statistical association between project awareness and information receipt/attention would be expected if a significant amount of the information that producers received in 1993 about project-promoted BMPs had come *directly* from project activities. BMP information from the projects could have been transferred to producers through non-project channels.

The *multi-variate analysis* indicates that neither a *producer's farm being located in a demonstration area* nor *awareness of the demonstration project in his area* were significant predictors of use of two of the BMPs. The multi-variate analysis, based on demonstration area and comparison area data from 407 producers, was confined to sites that conformed to two criteria for statistical analysis: sufficiently high rates of producer use of the same project-promoted BMPs (legume crediting and manure crediting qualified) and; survey samples with sufficiently large numbers of respondents (three states qualified).

Producers' *annual gross income* as well as *assessments* of these two BMPs (especially their perceived "practicality" and "simplicity") and *degree of attention* paid to information recently received about them were the leading predictors of their 1993 usages. *Producers' differential receptivity to information generally available about these BMPs appears to have been more important in determining their 1993 usages than the additional BMP information made available by the projects.*

Role of Field Demonstrations and Information and Education Processes

The quantitative analysis of this evaluation does not separate the influences of the field demonstrations and other information and education efforts from a host of other project elements. However, interviews with project staff clearly point to separate influences of the field demonstrations and other information and education efforts.

Intended project impacts may have been delayed because the initially planned result demonstrations, and other dissemination efforts, were deferred until a body of local test demonstration data was obtained—to assure the local applicability of project-recommended practices, including some of the designated BMPs. The two-to-four year time period required to develop this body of data apparently worked against quick influences by the projects toward adoption of the project promoted BMPs.

Several information and education processes are likely to have bolstered project effectiveness. First, some projects carried out fairly extensive formative evaluation surveys to augment their project planning. Second, professional communicator project staff members were seen as leading to more effective informational approaches and materials, increasing the likelihood of having impact upon producers. Third, some projects targeted specific kinds of producers through appropriate communication strategies. And fourth, some projects reported using extensive methods to solicit feedback from producers.

Communication channels used to promote BMPs were heavily interpersonal, with demonstration tours, field days, workshops and similar efforts forming the backbone of the I&E campaigns. Mass media use was limited mostly to smaller-scale community level media channels, required by the nature of the project sites. More extensive use of media tended to follow projects with more professional I&E staffing. There is little evidence that greater use of media channels *per se* accelerated transfer of information about water quality or about the BMPs. Rather, the *quality* of the content that went into particular media presentations likely mattered more, as did the *interplay* of media with interpersonal communication efforts.

In projects encompassing broader geographic areas, e.g., Nebraska's 15-county project, media would have been necessary, beyond interpersonal contacts, in order to disseminate information at a reasonable pace and price. In projects in small geographic areas, e.g., North Carolina's project, media may have been less important. There is little evidence that project efforts substantially altered producers' previous channels for seeking information on agricultural production strategies or practices.

Short-term versus Long-term Project Effectiveness

The demonstration projects have operated within vast, complex communication environments, loaded perhaps to the point of saturation with agricultural information. It was *no small accomplishment for the projects to have gained, on average, awareness and positive recognition by nearly half the producers across the eight demonstration areas, by early 1994.* This is especially the case given the small amount of information and education the projects appeared able to contribute, relative to the large magnitude of the overall mix of agricultural information and communication. A key question is how significant a role the projects played within this overall context. This evaluation suggests that the projects were a substantial but not a commanding information force within their areas.

Across all the projects, an average of about 25 percent of producers already were using the designated BMPs prior to project implementation. Thus, these practices already had moved through the *innovator* category of producers and well into the *early adopter* category, regarding the classical diffusion of innovations model. Statistically significant gains by 1994

were found in 19 percent to 40 percent of the adoption variables, regarding the BMP cases examined in the demonstration areas. In these cases, BMP awareness, familiarity and/or usage increased by an average of 15 percentage points. Here, producers were observed to have behaved consistently with project objectives, and over the first two years of full operation of the demonstration projects, adoption spread into the *early majority* adopter category. These increases in BMP awareness, familiarity, and usage soon after full project implementation may appear encouraging.

However, the following evidence works against the conclusion that these increases were due to *demonstration project impact*. Virtually no net gains were observed by early 1994 in adoption processes across the demonstration areas relative to the comparison areas. Findings cannot discount the possibility that factors other than the projects resulted in the observed gains in adoption processes in the demonstration areas. An interpretation is that BMP adoption processes have been slowly occurring throughout the agricultural communities observed, for a variety of reasons, and that even heavily focused demonstration and I&E efforts such as the ones evaluated here had undetectable impacts in the short-run.

If comparison areas had not been included in the evaluation, the findings might have been interpreted as suggesting that the demonstration projects had impact by close of 1993/ early 1994. This is a reminder that drawing inferences from data gathered *just* over time, without appropriate comparison data, can be risky.

The voluntary adoption of environmentally-sound agricultural practices generally is a slow process. Producer adoption of conservation and environmental practices and technologies tends to occur at a slower rate than that for more clearly economically advantageous ones. For example, the annual proportion of farmers who test soil for nutrients (varying from about 20 percent to about 80 percent, depending on the crop) changed little or not at all, between 1990 and 1995, for the production of corn, soybeans, cotton, wheat, and potatoes. (Anderson and Magleby 1997, 199–203).

It is an open question whether most of the producers viewed the economic advantages of the project-promoted BMPs as real and of significant magnitude. Moreover, previous communications research generally suggests that it is more difficult to influence preventive action than to influence action to gain specific rewards (Rogers and Storey 1997).

There was no indication here that producers regarded water pollution as a sufficiently immediate threat to prompt them to act in a way that could involve economic risk.

Adoption processes during this early period of the projects appear to have been slow but deliberate. *Findings show encouraging, strong links between individual producers' recent receipt of/attention to information about project-promoted BMPs (not accounting for source(s) of such information) and their awareness of, familiarity with, favorableness toward, and use of these BMPs.* The comprehensive model of adoption employed in this evaluation, as well as project staff views about project duration necessary to bring about widespread BMP adoption, suggest a potential for longer term project impacts.

Demonstration project impact would likely be detected by a follow-up impact evaluation, conducted in 1998. Support for this view is provided by the finding that, at least for legume crediting and manure crediting, higher income producers were more likely to have been users by 1994. Higher income generally is associated with early adoption, suggesting subsequent increases in adoption by other income groups. Moreover, the evaluation indicates that three to five years of project funding may be required for field demonstration findings to accumulate. Such accumulation appears necessary to influence producers' assessments of BMPs to a degree sufficient to induce their trying out the BMPs on a significant scale. The field demonstrations of the projects probably had little opportunity to influence producers' BMP assessments during the 1992–93 time period of this evaluation. Substantial field demonstration findings appear necessary to build producers' favorableness toward recommended BMPs.

A perspective concerning the time frame required for effectiveness in speeding widespread BMP adoption follows. This perspective is drawn from a composite of interviews with several demonstration project staff members across several projects. These project staff members asserted that demonstrating specific BMPs, getting producers to try them and finally adopt them, all take time. After a year or two to fully operationalize the project, three years are required to build producer familiarity and initial positive assessments, as specific BMPs are test-demonstrated. The next two years are needed for producers to try out the BMPs on a larger scale, and an additional three years are needed to build toward widespread adoption among area producers. This is a nine-year or ten-year timetable.

Recommendations for Water Quality Programming

Recommendations based on this evaluation complement those of two previous reports on the Water Quality Program of USDA and state cooperators, with implication for water quality programs conducted in the future. This evaluation's recommendations partly overlap with the recommendations of these preceding reports. Taken together, the three sets of recommendations cover a broad scope and apply to two organizational levels: i.e., state water quality *projects* and USDA national water quality *programs.*

Rockwell, Hay, and Buck (1991) provided recommendations focused on *issues that continued as challenges* by 15 months after initiation of the 1990 demonstration projects. These evaluators recommended: interagency assessment of project team processes as a regular (e.g., annual) procedure; acquiring more project resources for site-specific adaptive research; increasing flexibility of cost-share support; extending lessons learned from the demonstration projects to geographic areas outside the demonstration areas; increasing the precision of procedures for evaluating project effectiveness; and further integrating project education, technical assistance, and cost-sharing.

Meals, Sutton, and Griggs (1996) recommended 19 improvements in water quality programming based on their assessment of eight USDA Demonstration Projects and eight comparable Hydrologic Unit Projects. Their recommendations are divided into three categories, i.e.: *program and project planning* (e.g., establishing quantitative objectives for adoption of land treatment measures based on best available estimates of requirements to protect or improve area water quality); *staff training* in use of models and methods for monitoring and estimating project impacts on contaminant loadings as well as surface water and groundwater quality; and *project assessment* (e.g., documenting producer changes in land treatment and agri-chemical applications, and then estimating the water quality impacts of such adoption by use of simulation models).

Recommendations for Projects to Hasten Adoption of Water Quality Practices

Compared with the set of projects evaluated herein, future efforts to accelerate the voluntary adoption of BMPs should take greater advantage of contemporary research findings, principles, and procedures for planning, conducting, and evaluating demonstration projects/information and education campaigns. Several of the eight demonstration projects evaluated saw little advantage in, or were unable to employ principles and procedures that are typically recommended. Other of the projects used these principles and procedures to good advantage. These principles and processes have been employed in conducting numerous successful private and public sector communication/ persuasion projects (e.g., Rice and Atkin 1989; Backer, Rogers, et al. 1992; and O'Keefe, Rosenbaum, et al. 1996).

The recommendations below for future projects are respectfully offered in this context, with realization of the complexities and challenges of project development and management. The recommendations follow a project planning and development sequence, moving from "vision" for water quality projects to selection of project objectives and strategy, which in turn requires resource budgeting. Future projects should follow these guidelines, which generally reflect the best processes used by one or more of the 1990-initiated projects.

Vision for Water Quality Projects

- *Use comprehensive models, such as those used by this evaluation, to help provide an overarching vision and a basis for selecting water quality project objectives, strategy, structure, methodology, and resources.*

The projects could have further emphasized the use of models of program development and BMP adoption processes. For example, emphasis upon as basic a formulation as "the diffusion of innovations model" might have aided demonstration projects to identify more precisely the kinds of changes in BMP assessments that would have been required to induce increased adoption.

Projects should employ models of program development and BMP adoption processes, based on relevant research and experience, to select the best strategies for achieving BMP adoption. Models for setting specific objectives for changes in producers' awareness of, familiarity with, and assessments of project-promoted BMPs can help identify the needed strategy to encourage producers to adopt recommended BMPs.

Project Strategies and Methods

▶ *Conduct adaptive, site-specific research/test demonstrations as needed to assure or increase local applicability of project-promoted BMPs.*

Several projects reported difficulty in effectively promoting the BMPs they had selected, requiring these projects to conduct more site-specific tests of BMP relevance and cost-effectiveness than they had anticipated. Other of the projects seemed to have anticipated the need for local testing of BMPs, for producer profitability and feasibility, as well as for environmental cost-effectiveness. Adaptive research considerations should be planned and budgeted to insure that I&E content is both locally relevant and accurate. *Projects may need to use on-farm research to evaluate local adaptations of available research results to site-specific situations.*

It may be necessary to defer setting objectives for BMP adoption until formative evaluation and BMP field testing are completed. It may be appropriate to fund field testing through a connected research project funded by an agricultural or natural resource research organization.

Especially needed are more field evaluations of *profitability* of agricultural practices that protect/improve water quality. A recent analysis of the economic effects of the pre-sidedress nitrogen test for corn production, in Pennsylvania, can be viewed as a model (Musser, Kreahling, Roach, Huang, Beegle, and Fox 1995).

▶ *Use basic evaluation, marketing and promotional tools to improve program design, execution, and accountability.*

More of the projects could have used baseline surveys and formative evaluation, e.g., pretesting of communication materials and/or focus groups, in order to better understand producer assessments and other concerns. Lack of use of such formative evaluation made it difficult for some projects to effectively identify initial producer behaviors, needs, and capabilities toward segmented producer groups. Omitting the use of such tools also reduced the opportunity to tailor field demonstrations, I&E strategies and tactics, and technical and financial assistance in order to increase their combined effectiveness.

Projects should use baseline surveys, pretesting of communication materials, and/or focus groups to better understand initial producer needs, capabilities, and views. Project planners should design, "up front," an overall approach for evaluation of project situations including audience needs and needs of the public; project processes and outputs; and outcomes as well as project impacts. This planning includes advance identification of data to be collected; methods to collect and analyze the data; methods to utilize the findings; and staff and budget needed. Implementation of such "up front" evaluation design ensures definition of baseline conditions and values; basis for mid-course corrections; and ability to document progress toward outcomes as well as project impacts. These in turn provide the basis for effective marketing and promotional efforts based on evidence of program/project accomplishments.

▶ *Segment audiences according to their goals and assessments of water quality problems and BMPs to increase project effectiveness and efficiency.*

Some of the projects segmented audiences based upon data or staff perceptions regarding existing producer views and behaviors. (For example, producer attitudes toward agricultural innovations in general were a basis for segmentation in one project). However, the projects generally did not report using such a strategy. There is evidence from this evaluation that receiving information about project-promoted BMPs often did not convince producers that the BMPs would increase their profits and/or be sufficiently easy to use. Audience segmentation techniques can help projects to be more convincing to producers.

Three findings from this evaluation may help illustrate how knowledge of producer communication environments and patterns, and of producer characteristics and views related to adoption, can help develop strategies to make projects more effective and efficient.

First, this evaluation suggests that projects could plan strategy based on *preliminary collection of data on producer assessments of project-promoted BMPs.* For example, this evaluation found that producers who assessed BMPs as "practical," and "simple" were also more inclined to use them.

Early in a project's life, staff should ascertain producers' assessments of project-promoted BMPs and the bases for these assessments. Then staff can develop and/or assemble as well as convey to producers—through their involvement in project activities—the specific information needed to increase producers' favorableness toward these BMPs, as means of meeting *producers' objectives.*

Future projects should consider incorporating into their baseline surveys at least a simplified form of the BMP assessment/attitude scales used by this evaluation. Data from these scales could identify which perceived attributes of individual BMPs are likely to advance/prevent BMP adoption among audience segments. *Such foreknowledge can help plan test/result demonstration and communication strategies to reach segments of producers with differing assessments of BMPs.*

Second, this evaluation reinforces the principle that projects should consider the factor of *producer income* in planning project strategy. This evaluation identified producer income as an important predictor of use of BMPs. Much past literature on adoption of agricultural practices (e.g., Nowak 1987; Thomas, Ladewig, and

McIntosh 1990) asserts that producers' income is generally associated with their early adoption of research-based practices.

Project strategy could utilize the above principle by *sequencing* audience involvement in project activities. Higher income audiences might be targeted first, so that they could serve as opinion leaders to encourage adoption by other producers.

On the other hand, it may be argued that higher income audiences frequently make needed changes without much help from public sector agencies. Perhaps *public* agency priority should place emphasis on reaching more difficult segments of the audience. In accepting such tough assignments, progress is likely to be slower than with higher income audiences. Agency administrators and funding sources may need to be convinced that it is important to accept the slower progress inherent in tackling difficult audience segments.

A third and a related example of the potential necessity of audience segmentation, as suggested by this evaluation, is the possible need for water quality projects to target *"hard core"* producers. Findings suggest that there are sizeable proportions of producers who have outlooks resistant to adopting agricultural practices that improve/protect water quality. These producers:

(a) see farmers as having little or no impact on water pollution;
(b) believe farm practices have no impact on water quality in their respective communities;
(c) do not agree that producers have much responsibility to protect water quality in their communities;
(d) are not familiar with some of the project-recommended BMPs;
(e) have reservations about whether using the project-promoted BMPs will increase their profits; and
(f) have reservations about the feasibility of using recommended BMPs.

To the extent that sizeable numbers of producers *share* the above views, there will be a strong challenge to obtaining *voluntary* adoption of BMPs to the extent that there is sufficient protection/improvement of water quality at the area level.

In order to achieve area-wide water quality protection/improvement, projects may need to spend more time documenting area water quality problems and addressing the particular reservations of audience segments which most resist voluntary adoption of project-recommended BMPs.

▶ *Develop measurable BMP adoption objectives within a national program framework.*

Project objectives rarely were precise. Ideally, the projects would have set objectives quantitative for *which project-recommended* BMPs were to be adopted to *what extent and* by *what date*—by each segment of the overall audience of producers.

Defining satisfactory levels of BMP adoption—for different types of producers to attain by the end of the project time period—would have guided not only programming but also the evaluation of program results.

Project objectives and strategy for their achievement should be developed through broad involvement of community stakeholders. Project planners and stakeholders should select BMP adoption objectives that can reasonably be achieved, and co-select with evaluators the methods to be used to determine whether the objectives are met. Selection should be based on local hydrologic, agronomic, and economic conditions; on local cultures and history; and on rates of adoption that might be reasonably expected for the particular BMPs considering the resource level of the project and complementary influences.

Objectives for BMP adoption may be achieved through implementing project strategies for test demonstrations/result demonstrations, information transfer and education. These must be integrated with technical and financial assistance efforts of the projects in order to maximize project effectiveness

Resource Budgeting

▶ *Integrate and focus project budgets to achieve project objectives.*

A greater number of the project budgets could have taken into account the costs required to utilize the above recommendations including the costs of formative evaluation (e.g., collection of baseline data including producer assessments of project-promoted BMPs) and any need for local testing and improvement of generally-recommended management practices. The collection of baseline data including producer assessments of BMPs being considered for project promotion, as well as and site-specific, adaptive research efforts, must be tied by appropriate funding mechanisms to result demonstrations and other I&E efforts.

Ideally, budgets of all projects are justified and integrated around their respective project objectives. Implementing the above-presented five planning and strategy recommendations for project improvement depends upon project budgets being in-place to drive such implementation.

Absence or weakness in demonstration project use of the above recommended elements of effective programming may have been due in some projects to lack of experienced/trained staff, and in other projects to lack of financial resources. Use of these elements requires *consistency of vision, planning and execution* across time and circumstance. Such consistency can be elusive in a multiagency effort facing challenges of shifting and/or occasionally "thin" personnel assignments together with uncertain budgetary futures.

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